THE DEVELOPMENT AND TESTING OF RECIPES FOR PATIENTS WITH CHRONIC RENAL FAILURE

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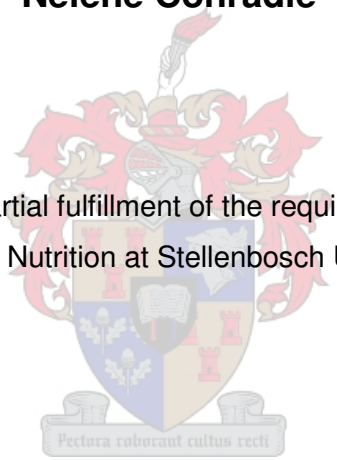

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DECLARATION

By submitting this thesis electronically, I declare that the entirety of the work contained therein is my own, original work, that I am the owner of the copyright thereof and that I have not previously in its entirety or in part submitted it for obtaining any qualification.

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ABSTRACT

Background

Patients with chronic renal failure must deal not only with the disease itself, but also have to follow a strict dietary regimen. In South Africa there is currently a great demand for new and updated recipes based on the South African Renal Exchange Lists. The focus of this research was the development and testing of recipes commonly used by renal patients following a westernised diet.

Objectives

The main objectives of the study were to develop and test recipes that meet the nutritional requirements of patients with chronic renal failure. The secondary objectives were to determine the gender and racial differences in participants' responses during consumer sensory testing.

Methodology

The study population consisted of patients with chronic renal failure on hemodialysis and continuous ambulatory peritoneal dialysis from Tygerberg Academic Hospital (TAH). Data was collected in three phases, using census sampling: Phase 1 included the development and adaptation of recipes to suit the renal diet. Phase 2 included the consumer sensory testing of the recipes by the dialysis patients, using the 9-point hedonic scale. Phase 3 included the rating of the recipes, the final nutritional analysis and allocation of renal exchanges to one portion of each recipe, as well as the final formatting of the recipe to make it more user-friendly for the renal patient.

Results

In total, 45 patients took part in the sensory evaluation of 30 recipes. Eighty percent of the subjects were coloured, 4% were white while 16% were black. Fifty-one percent (n=23) were female and 49% (n=22) were male. Of the 30 recipes that were evaluated for overall acceptance, appearance, smell, texture and taste, only 7 were deemed unacceptable. Recipes were unacceptable when less than 80% of the study participants gave a mean overall score of more than 6. Significant differences in the overall acceptability scores were found between the male and female subgroups for the *Fish and Vegetable Pie* (p=0.031), *Chicken Pilaf* (p=0.008) and *Date Fingers* (p=0.002). The females showed a greater preference for these two main meals while the males showed a greater preference for the *Date Fingers*. Significant differences were found between the black and westernised subgroups for the *Rice Salad* (p=0.006), *Wheat and Mushroom Casserole* (p=0.022), *Curried Wheat Salad* (p=0.043) and the *Coconut Ice* (p=0.005), with the westernised subgroup showing a greater preference for the dishes than the black subgroup.

Conclusion

The 23 recipes that were acceptable to the study participants are recommended for inclusion in the RenalSmart Software programme. These recipes are suitable for patients following a westernised diet. It is proposed that recipes suitable for the black and Indian population must be developed in future research.

OPSOMMING

Agtergrond

Pasiënte met chroniese nierversaking moet nie net slegs die siektetoestand hanteer nie, maar moet ook ‘n streng dieet regime volg. Daar is huidiglik in Suid-Afrika ‘n groot behoefte vir nuwe en opgedateerde resepte gebasseer op die Suid-Afrikaanse Nier Ruillyste. Die fokus van hierdie navorsing was om resepte te ontwikkel en te toets wat algemeen ingeneem word deur nierversaking pasiënte wat ‘n westerse dieet volg.

Doelwitte

Die hoof doelwitte van die studie was om resepte te identifiseer en te toets wat voldoen aan die nutrisionele behoeftes van nierpasiënte met kroniese nierversaking. Die sekondêre doelwitte was om geslag en ras verskille in die deelnemers se reaksies tydens verbruiker sensoriese evaluering te bepaal.

Metodologie

Die studie populasie het bestaan uit pasiënte met chroniese nierversaking op hemodialise en aaneenlopende ambulatoriese peritoneale dialise van Tygerberg Akademiese Hospitaal (TAH). Data was versamel in drie fases deur gebruik te maak van sensus steekproeftrekking: Fase 1 het die ontwikkeling en aanpassings van die resepte, om dit toepaslik te maak vir die nier dieet, ingesluit. Fase 2 het die verbruiker sensoriese evaluering van die resepte deur die dialise pasiënte, met behulp van die 9-punt hedoniese skaal, ingesluit. Fase 3 het die klassifisering van die resepte, die finale nutrisionele analise en die toekenning van nier ruile per porsie van elke resep, sowel as die finale formatering om die resep meer gebruikers-vriendelik te maak vir die nierpasiënt, ingesluit.

Resultate

In totaal het 45 pasiënte aan die sensoriese evaluering van die 30 resepte deelgeneem. Tagtig persent van die deelnemers was kleurling, 4% was wit en 16% was swart. Een en vyftig persent (n=23) was vroulik en 49% (n=22) was manlik. Van die 30 resepte wat ge-evalueer is vir algehele aanvaarding, voorkoms, reuk, tekstuur en smaak, was slegs 7 onaanvaarbaar gevind. Resepte is as onaanvaarbaar beskou indien minder as 80% van die deelnemers ‘n gemiddelde algehele telling van meer as 6 gegee het. Beduidende verskille in die algehele aanvaarbaarheid tellings is gevind tussen die mans en vroue vir die *Vis en Groente Pastei* (p=0.031), *Hoender Pilaf* (p=0.008) en *Dadelvingers* (p=0.002). Die vrouens het ‘n groter voorkeur vir die twee hoofgeregte getoon terwyl die mans ‘n groter voorkeur vir die *Dadelvingers* getoon het. Beduidende verskille is gevind tussen die swart en westerse sub-groepe vir die *Rysslaai* (p=0.006), *Koring en Sampioen Kasserol* (o=0.022), *Kerrie Koringslaai* (p=0.043) en die *Klapperys* (p=0.005), met die westerse sub-groep wat ‘n groter voorkeur vir dié geregte toon as die swartes.

Gevolgtrekking

Die 23 resepte wat aanvaarbaar gevind is sal voorgestel word om ingesluit te word in die RenalSmart Sagteware program. Die resepte is toepaslik vir pasiënte wat ‘n westerse dieet volg. Daar word voorgestel dat resepte toepaslik vir die swart en Indiër populasie ontwikkel word in toekomstige navorsing.

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LIST OF ACRONYMS AND ABBREVIATIONS

BMI	Body Mass Index
CAPD	Continuous ambulatory peritoneal dialysis
CARI	Caring for Australians with renal impairment
CRF	Chronic renal failure
CVD	Cardiovascular disease
GFR	Glomerular filtration rate
HD	Hemodialysis
MIA	Malnutrition Inflammation-Atherosclerosis
MICS	Malnutrition-Inflammation Complex Syndrome
NKF-KDOQI	National Kidney Foundation - Kidney Disease Outcomes Quality Initiative
PEM	Protein energy malnutrition
QMFCI	Quartermaster Food and Container Institute
TAH	Tygerberg Academic Hospital
UK	United Kingdom
US	United States

LIST OF DEFINITIONS

Ageusia: Absence of the sense of taste.[1]

Anosmia: Absence of the sense of smell.[1]

Cardiovascular disease: Any disorder that affects the heart's ability to function normally.[2]

Chronic renal failure: Kidney damage for ≥ 3 months, as defined by structural or functional abnormalities of the kidney, with or without decreased glomerular filtration rate (GFR), that can lead to decreased GFR, manifest by either pathological abnormalities; or markers of kidney damage including abnormalities in the composition of the blood and urine, or abnormalities in imaging tests. GFR <60ml/min/1.73m^2 for ≥ 3 months, with or without kidney damage.[3]

Consensus profiling: A descriptive test where four to six trained panelists, making use of extensive reference materials, must work together to achieve agreed standards for the description and intensity rating of odour, flavour, taste and feeling factors.[4]

Continuous ambulatory peritoneal dialysis: dialysis using of the semi-permeable membrane of the peritoneum. A catheter is surgically implanted in the abdomen and into the peritoneal cavity. Dialysate containing a high-dextrose concentration is instilled into the peritoneum, where diffusion carries waste products from the blood through the peritoneal membrane and into the dialysate. This fluid is then withdrawn and discarded, and new solution is added.[5]

Conventional profiling: A descriptive test where four to six trained panelists, making use of extensive reference materials, must work together to identify the attributes of a product and then individually assign rating/scores to the products.[4]

Culture: A way of life in which there are common customs for behaviour and in which there is a common understanding among members of the group.[6]

Duo-Trio test: A discrimination test in which three items are presented – a reference and then two test items – one of which matches the reference and the other which is a variation of the variable under investigation. The judge's task is to match the correct test item to the reference.[7]

Ethnic: Pertains to basic divisions of mankind into groups that are distinguished by customs, characteristics and language.[6]

Free choice profiling: A descriptive method in which untrained or minimally trained panelists evaluate products using their own individual set of descriptors.[7]

Hedonic: Referring to the likes, dislikes or preferences of a person.[7]

Hemodialysis: The removal of certain elements from the blood by virtue of the difference in the rates of their diffusion through a semi-permeable membrane. Two distinct physical processes are involved, diffusion and ultrafiltration.[1]

Hypogeusia: Diminished sensitivity of taste.[1]

Just-right scales: The scale measures the desirability of a specific attribute, and these scales are often used to determine the optimum levels of attributes in a product.[7]

Non-forced preference tests: A preference test where two samples are presented simultaneously and the panelist are asked to indicate which of the two products is preferred, although the panelist also has a “no preference” option.[8]

Panel: A group of people that comprises a test population chosen for specific characteristics such as product usage, sensory acuity, or willingness to participate in repeated sensory tests.[7]

Paired comparison test: A discrimination test procedure in which two products are presented and the judge’s task is to choose the one that is perceived as higher or more intense in a specified attribute.[7]

Paired preference test: A preference test where two samples are presented simultaneously and the panelist are asked to indicate which of the two products is preferred.[8]

Preference ranking: A test involving choice or ranking of two or more products for their appeal on a sensory basis.[7]

Protein energy malnutrition: The lack of sufficient energy or protein to meet the body's metabolic demands, as a result of either an inadequate dietary intake of protein, intake of poor quality dietary protein, increased demands due to disease, or increased nutrient losses.[9]

Quantitative descriptive analysis: A proprietary descriptive analysis method characterized by the use of line scales, replicated experimental designs, consumer-orientated descriptive terminology and use of analysis of variance.[7]

Ranking tests: The act of sorting a group of products with respect to the perceived intensity of a sensory attribute or the degree of liking.[7]

Rating scales: A scale where the judge's task is to apply numerical values or numerical response categories to products based on their sensory attributes.[7]

Renal exchanges: A practical tool used by dietitians to convert a diet prescription into a meal plan. The system sorts foods into groups with similar nutrient content.[10]

Sensory evaluation: A synonym for subjective evaluation; measurements determined by using the senses of sight, smell, taste and sometimes touch.[11]

Time-intensity descriptive analysis: A class of methods involving the evaluation of sensory attributes or hedonics over time after the exposure to a sample of a product; often involving the measurement of rate of change, duration, or other time-related parameters of sensation.[7]

Triangle test: A discrimination test in which three products are presented, two being the same and a third that is a different version of the variable under supervision. The judge's task is to choose the item that is most different from the other two.[7]

CHAPTER 1: LITERATURE REVIEW AND MOTIVATION FOR THE STUDY

1.1 INTRODUCTION

Chronic renal failure (CRF) is increasingly being acknowledged as a worldwide public health problem which leads to progressive renal failure, cardiovascular disease and premature death.[12,13] Worldwide there are well over 1 million people on maintenance dialysis,[14] with more than 350 000 in the United States (US) alone.[15] The patient on maintenance dialysis experiences low quality of life, high hospitalisation rates and a high mortality rate, despite improvements in dialysis treatment and techniques.[16]

Patients with CRF must deal not only with the disease itself, but also with conflicting feelings about the treatment process, the changes in the quality of their lives and adapting to a chronic progressive illness. Renal patients usually need to take several medications and have to follow a strict dietary regimen,[17] while taste changes and other factors influencing their nutritional intake makes adapting to their changed lifestyle even more challenging. Recipes for the South African renal patient, based on the South African Renal Exchange Lists of 2005,[10] are non-existent and therefore developing recipes suitable for these patients has become very necessary.

1.2 THE DIETARY REQUIREMENTS OF PATIENTS WITH CHRONIC RENAL FAILURE

The dietary requirements of patients with CRF are not only complex but also unique for each patient and may vary with changes in the patients' condition and medical treatment. It is a challenge for renal dietitians to prescribe a diet suitable for patients' individual needs and patients often experience difficulties grasping the concept of the diet and renal exchange lists.

In theory, patients in South Africa with early renal impairment should be treated in a primary care setting and only referred to a specialist late in the course of renal failure, but this is not always the case. An increased number of private hospitals and private dialysis units have emerged in the last couple of years, and therefore, a dietitian who is not a renal specialist will often have to care for renal patients. To ensure optimal dietary management it is thus crucial that standardised evidence-based guidelines exist for all dietitians to treat renal patients.[18]

Several international nutritional guidelines exist for patients with CRF:

- The Australian Caring for Australians with renal impairment (CARI) guidelines[19]
- The Canadian Society of Nephrology Professional practice guidelines[20]
- The European Best Practice guidelines for patients with renal disease[21]
- The US National Kidney Disease Outcomes Quality Initiative (NKF-KDOQI)[22]
- The United Kingdom (UK) guidelines[23]

1.2.1 Renal Smart guidelines for patients with Chronic Renal Failure

The Renal Smart guidelines for patients with CRF were developed using various scientific sources.[24-29] These guidelines are used nationwide in South Africa and are summarised in Table 1.1.

Table 1.1: Renal Smart guidelines for patients with chronic renal failure[24-29]

	PRE-DIALYSIS	HAEMODIALYSIS	PERITONEAL DIALYSIS
Protein (g/kg/d)	*ADA/RPG:* 0.6 – 1.0	*ADA/RPG:* 1.2	*ADA/RPG:* 1.2 – 1.3
	BDA/RNG: 0.6 – 1.0		
	CARI: ≥ 0.75		
	EDTNA/ERCA: 0.6 - 1.0	*EDTA/EBPG:* At least 1.0	*EDTA/EBPG:* ≥ 1.2
	ESPEN: 0.55 - 0.6	*ESPEN:* 1.2 – 1.4	*ESPEN:* 1.2 – 1.5
	NKF K/DOQI: 0.6 – 0.75	*NKF K/DOQI:* 1.2	*NKF K/DOQI:* 1.2 – 1.3
High biological value protein (%)	*ADA/RPG:* 50	*ADA/RPG:* >50	*ADA/RPG:* >50
	BDA/RNG: 60		
	CARI: ≥50		
	EDTNA/ERCA: >55		
	ESPEN: 66	*ESPEN:* >50	*ESPEN:* >50
	NKF K/DOQI: >50	*NKF K/DOQI:* >50	*NKF K/DOQI:* >50
Energy (cal/kg/d)	30 – 35	30 – 35	30 – 35
Fat (%TE)	25 – 35	25 – 35	25 – 35
Saturated fat (%TE)	<7	<7	<7
PUFA (%TE)	≤10	≤10	≤10
MUFA (%TE)	≤20	≤20	≤20
Cholesterol (mg/d)	<300	<300	<300
CHO (%TE)	50 - 60	50 - 60	50 - 60
Fiber (g/d)	20 – 30 (5 – 10 soluble)	20 – 30 (5 – 10 soluble)	20 – 30 (5 – 10 soluble)
Plant sterols / stanols (g/d)	Consider 2 g/d	Consider 2 g/d	Consider 2 g/d
Sodium (mg/d)	1000 - 4000	1000 - 4000	2000 - 4000
Water (ml/d)	Output + (500 – 750)	1000 - 2000	1000 - 3000
Potassium (mg/d)	2000 – 3000 / 40 mg/kg	2000 – 3000 / 40 mg/kg	2000 - 4000
Calcium (mg/d)	<2000 (<1500mg from binders)	<2000 (<1500mg from binders)	<2000 (<1500mg from binders)
Phosphorous (mg/d)	800 – 1000 / 10 - 15* mg/g prot	800 – 1000 / 10 - 15* mg/g prot	800 – 1000 / 10 - 15* mg/g prot
Iron	Individualise	Individualise	Individualise
Zinc	Individualise	Individualise	Individualise
Thiamine (mg/d)	1.1 - 1.5	1.1 - 1.5	1.1 - 1.5
Riboflavine (mg/d)	1.8	1.1 – 1.3	1.1 – 1.3
Pantothenic acid (mg/d)	5	5	5
Niacin (mg/d)	14 - 20	14 - 20	14 - 20
Pyridoxine (mg/d)	5	10	10
Vit B_{12} (µg/d)	2-3	2-3	2-3
Folate (mg/d)	1.0	1.0	1.0
Vit C (mg/d)	60 - 100	60 - 100	60 - 100
Vit A (µg/d)	No supplementation	No supplementation	No supplementation
Vit D (µg/d)	Individualise	Individualise	Individualise
Vit E (mg/d)	0 – 15 (Individualise)	0 – 15 (Individualise)	0 – 15 (Individualise)
Vit K (µg/d)	Individualise	Individualise	Individualise

* Based on average phosphate content per gram of protein (South African renal exchange lists) for practical reasons; always aim for 800 – 1000 mg P/ g protein per day.

**Published with the permission of the developers of the Renal Smart programme[24]

1.2.2 The South African Renal Exchange Lists

The renal exchange list is a practical tool used by dietitians to convert a diet prescription into a meal plan. The system sorts food into groups with similar nutrient content.[10]

The first exchange lists that were used in the planning of diets were for patients with diabetes and those on weight loss diets developed by the American Dietetic Association, the American Diabetes Association and the US Public Health Service in 1950.[30] Before 2005, a variety of renal exchange lists were used for the planning of renal diets in South Africa, but most of these exchanges were variations of those used in other countries and did not include traditional foods included in South African meals.[10]

The South African renal exchange lists were developed in 2005.[10] During the development process, the results from the Report on South African Food Consumption Studies undertaken amongst different population groups (1983 – 2000) [31] were used to identify food items frequently consumed by the South African population and dietitians with knowledge of the eating habits of the Moslem, Indian, black, coloured and white groups were consulted regarding the inclusion of cultural foods. As many foods as possible were included in the lists, to avoid an overly restrictive diet, but care was taken not to make the lists too long and cumbersome. The result was a list of renal exchanges suitable for the South African person with chronic renal failure.[10]

Despite the guidelines and renal exchange lists that were developed for the South African renal patient, successful implementation of renal diets may be hampered by the patients' resistance to change, as well as factors contributing to poor food intake which affect the nutritional status of the patient.

1.3 FACILITATING DIETARY CHANGE IN RENAL DISEASE

It is expected of patients suffering from chronic disease to make dietary changes, accept personal responsibility for their dietary intake and to maintain an altered lifestyle; however this can sometimes be overwhelming and confusing to the patient, causing resistance to change, which is a natural reaction.[32] Some of the reasons why individuals resist change include:

- Lack of understanding of the need for change
- Misunderstanding of the change and its complications
- Believing that the change is not in their best interest
- Lack of trust in those introducing change[33]

Various models have been postulated to explain change management. The *Stages of Change Model*, originally designed to guide the study on smoking behaviour,[34] describes readiness and how people move towards making decisions and behavioural change.[35] It describes the process in which an individual progress through a series of six distinct stages of change (Figure 1.1). According to the model, in changing, an individual moves from pre-contemplation to maintenance. If a relapse occurs, then the individual will re-enter the process at any point.[36] It is thus pertinent to determine in which stage an individual is before dietary counseling can commence.[37] Behavioural change is more successful using this approach than assigning the same intervention techniques to everyone, regardless of their readiness or the stage of change.[36] The Stages of Change model can be applied to newly diagnosed patients with CRF as well as patients who's dietary prescription has changed due to their medical treatment.

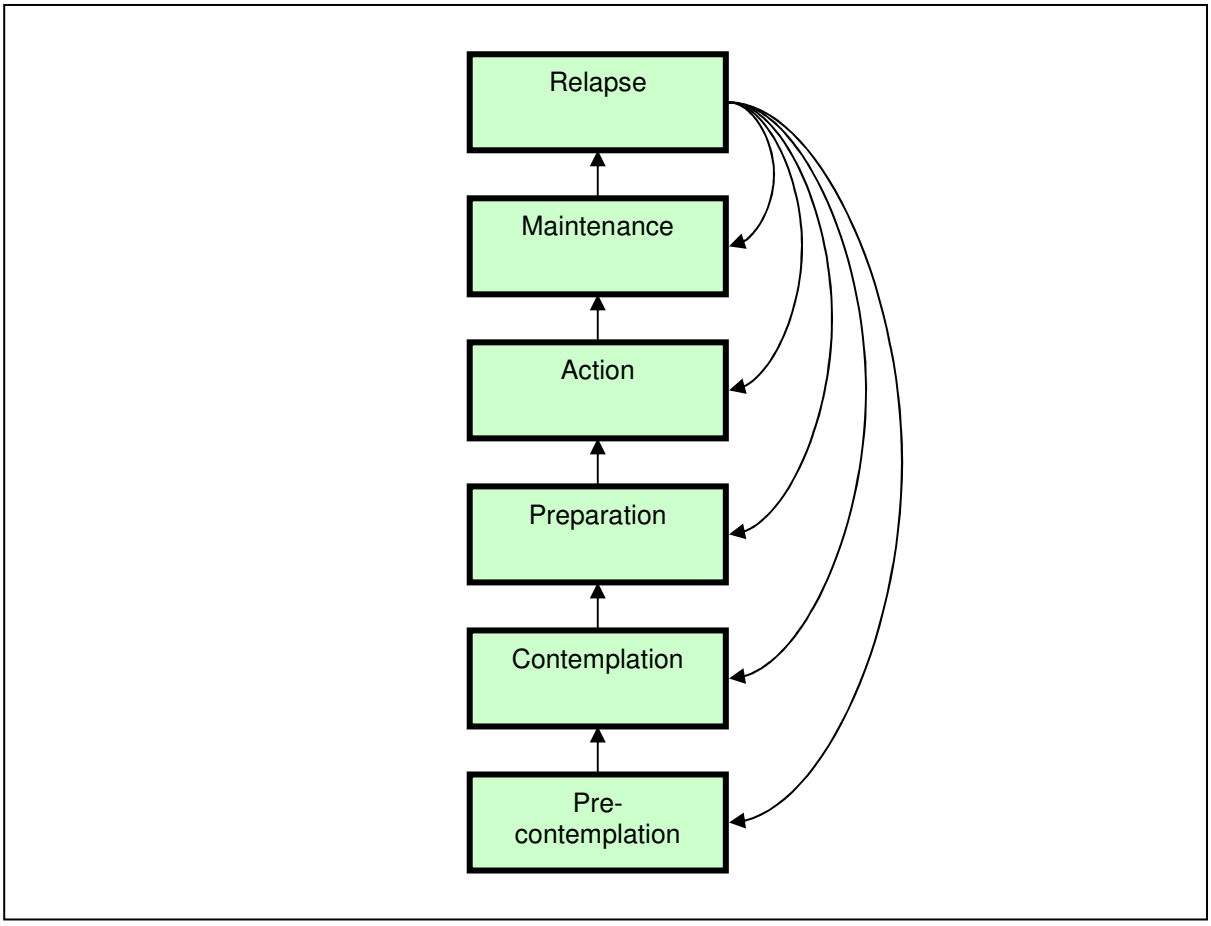


Figure 1.1: Stages of Change Model[34,36,38]

The six stages can be defined as:[36]

Pre-contemplation*:* At this point the patient has not even contemplated having a problem or needing to make a change.

For example: This may be during early CRF when the patient does not realise that he/she has a chronic disease.

Contemplation: Once some awareness of the problem arises, the person enters a period of ambivalence. The patient seesaws between reasons to change and reasons to stay the same.

For example: This may be upon diagnosis of CRF when the patient realises that dietary change may be required.

Preparation: This is a window of opportunity that either allows the patient to move forward or fall back into contemplation.

For example: At this stage the renal patient will most likely be willing to consult a dietitian, although they are still deciding whether they will change their dietary behaviour or not.

Action: The patient engages in actions that bring about change.

For example: At this stage the patient is ready to change their dietary behaviour and will put the theory of the renal dietary prescription into practice.

Maintenance: During this stage the challenge is to sustain the change and to prevent relapse.

*For example***:** The challenge the renal patient now faces is to stay compliant with the dietary prescription.

Relapse: If relapse occurs, the challenge for the patient is to start the change process again rather than become stuck at this stage.

*For example***:** For the renal patient, relapse can occur at any stage. Understandably, patients find it very challenging to change their dietary behaviour when medical treatment (such as starting on dialysis) or complications require it, and therefore relapse at this stage is more likely.

According to Sutton *et al*. who evaluated patients' perceptions of renal dietary advice in the UK, most patients with renal disease felt that for them to accomplish successful behavioural change, they would like to receive dietary advice on diagnosis. Written diet sheets, followed by menu ideas and recipes, was the most preferred method of communicating the prescribed dietary guidelines.[32] Renal dietitians were also identified by the patients as the most reliable and trustworthy source of renal dietary information, while the internet, word-of-mouth information as well as information from other health professionals caused confusion and frustration. Another difficulty that the patient has to overcome, is to understand that the dietary advice that they receive will vary according to the stage of their renal disease and the

medical treatment. These variations can cause further confusion and frustration.[32,39] Thus, the task of the dietitian - to successfully counsel the patient with renal disease - can become time-consuming, require several follow-ups, and even be frustrating at times, especially if the patient is not ready to change his/her dietary behaviour.

1.4 FACTORS AFFECTING THE NUTRITIONAL STATUS OF THE RENAL PATIENT

Patients with CRF on dialysis are often malnourished.[40-46] The causes of Protein - Energy Malnutrition (PEM) are not always clear, but some probable causes are listed in Table 1.2, some of which may be associated with inflammation.[46]

Table 1.2: Causes of PEM in dialysis patients[45-47]

Inadequate nutrient intake	Anorexia caused by: Uremic toxicity Impaired gastric emptying Inflammation with/without co-morbid conditions* Emotional and/or physical disorders
Dietary restrictions	Prescribed restrictions: Low-potassium, low phosphate, low sodium regimes Limited food choices and recipes Social constraints: Poverty, inadequate dietary support Physical incapacity: Inability to acquire and/or prepare food and/or to eat
Nutrient losses during dialysis	Losses through hemodialysis membrane into hemodialysate Adherence to hemodialysis membrane or tubing Losses into peritoneal dialysate
Hypercatabolism cause by comorbid disease	Cardiovascular diseases* Diabetic complications Infection and/or sepsis* Other comorbid conditions*
Hypercatabolism associated with dialysis treatment	Negative protein balance Negative energy balance
Endocrine disorders of uremia	Resistance to insulin Resistance to growth hormone and/or IGF-1 Increased serum level of or sensitivity to glucagons Hyperparathyroidism Other endocrine disorders

Acidemia with metabolic acidosis	Increased catabolism of branched chain amino acids
Concurrent nutrient losses with frequent blood loss	Iron losses
Changes in the taste of food	Poor dietary intake

* The given factor may also be associated with inflammation

It has been suggested that inflammation is a contributing cause of both PEM and cardiovascular disease events (CVD). The terms malnutrition-inflammation complex syndrome (MICS) and malnutrition inflammation-atherosclerosis (MIA) syndrome have been coined to indicate this interaction and the link to a poor clinical outcome.[46,48] Causes and outcomes of inflammation in dialysis patients are shown in Figure 1.2.

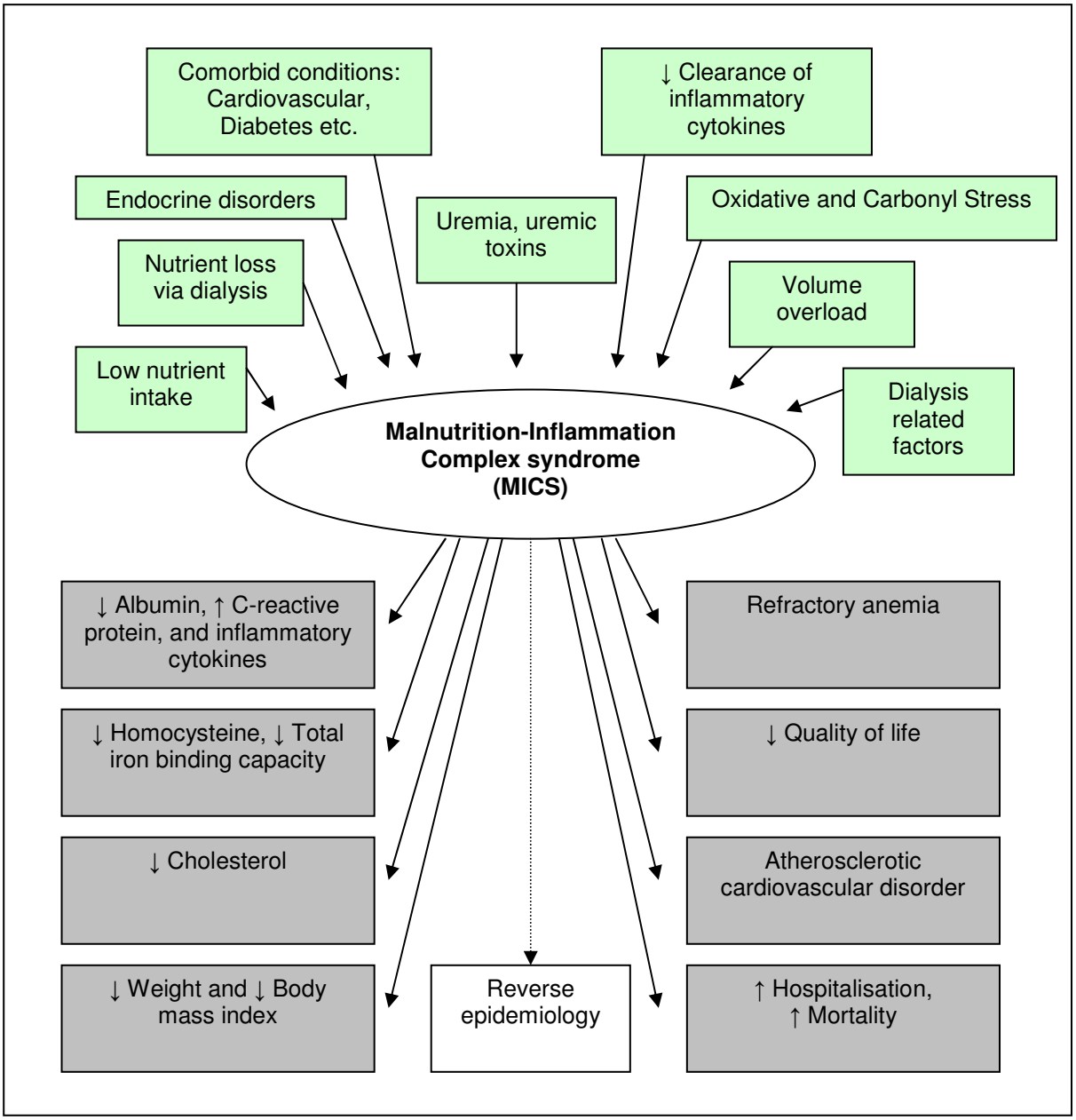


Figure 1.2: Schematic representation of the causes and consequences of Malnutrition-Inflammation complex syndrome [46]

Traditionally, indicators of over-nutrition such as high cholesterol or body mass index (BMI), which are associated with an adverse outcome in the general population, can be considered positive factors for survival outcome in dialysis patients.[46,48] PEM worsens with progression toward end-stage renal disease. This is a major predictor of poor clinical outcome as reflected by the strong association between hypo-albuminaemia and cardiovascular disease.[48]

Thus, although malnutrition in renal patients is very common, it is possible that through the correct dietary prescription, guidance, as well as suitable recipes available to renal patients, the incidence of malnutrition in these patients can be decreased.

1.4.1 Taste Changes in Renal patients

Abnormalities in taste function may contribute to poor dietary intake in patients with CRF. [46,49] Two components of taste may be affected including taste threshold and alterations of taste. A high threshold will result in the patient perceiving that food is tasteless, whereas food that tastes different than usually experienced (taste alterations) may also result in reduced intake.[49] Some explanations for renal patients experiencing changes in taste include metabolic disturbances, deficiency of multiple micronutrients due to decreased food intake and alterations of peripheral nerve function.[50,51] Drugs may also either decrease or increase sensitivity to a certain taste.[52] Patients receiving renal replacement therapy such as hemodialysis (HD), continuous ambulatory peritoneal dialysis (CAPD) and with chronic uremia have been shown to be affected the most by taste changes.[45] Contradictory findings of taste acuity in HD patients have been published.[53] Sweet and sour, and not salt and bitter tastes have commonly been shown to be affected in HD patients and those with chronic uremia. It has been found, however, that taste improves immediately after dialysis although not to normal levels, possibly due to the decrease in toxins accumulated between dialysis.[54,55] However, the specific accumulating toxins that play a role are unknown.[51] Contrary to these findings, Fernstrom *et al*. reported that the detection of salty tastes was also impaired in HD patients prior to dialysis[56] and Matsuao *et al*. found that bitter tastes and total taste acuity were impaired in diabetic HD patients.[53] Few studies have examined taste in CAPD patients but according to research by Middleton *et al*, CAPD patients have a higher taste detection threshold for salt and bitter than normal controls,[50] while research by Ng *et al*. showed a higher taste detection threshold for salt alone.[49] Other research, however, has failed to demonstrate a difference in taste in this population.[56] Additionally, Astbäck *et al*. found that patients with CRF have fewer fungiform taste buds compared to healthy controls, suggesting an important contributing factor to the impairment of taste acuity.[57] The benefit of zinc supplementation remains controversial, since some researchers found an improvement in taste acuity with zinc supplementation[58,59] while others report that it does not improve the disturbance of taste perception in HD patients.[60]

When all factors affecting nutritional intake in patients with CRF are considered, including the possible taste changes that may or may not occur depending on the individual, it can be a challenging task to develop suitable recipes that will be acceptable to all these patients.

1.5 DEVELOPMENT OF RECIPES SUITABLE FOR PATIENTS WITH CHRONIC RENAL FAILURE

Recipe development is a creative process but it also incorporates sound scientific techniques. It involves the complete process of creating a unique recipe from a single idea/concept, according to specific objectives. This process ensures that a recipe becomes standardised to meet specific requirements through testing, evaluation and adjusting.[61] Standardising a recipe is the ultimate goal of the recipe development procedure. All standardised recipes must be complete, accurate and reliable to ensure acceptance of the final product and a constant yield. Recipe development can be accomplished by reviewing an existing recipe to alter or improve it, or by developing a completely new recipe.[61] The main steps of recipe development and testing are summarised in Figure 1.3.

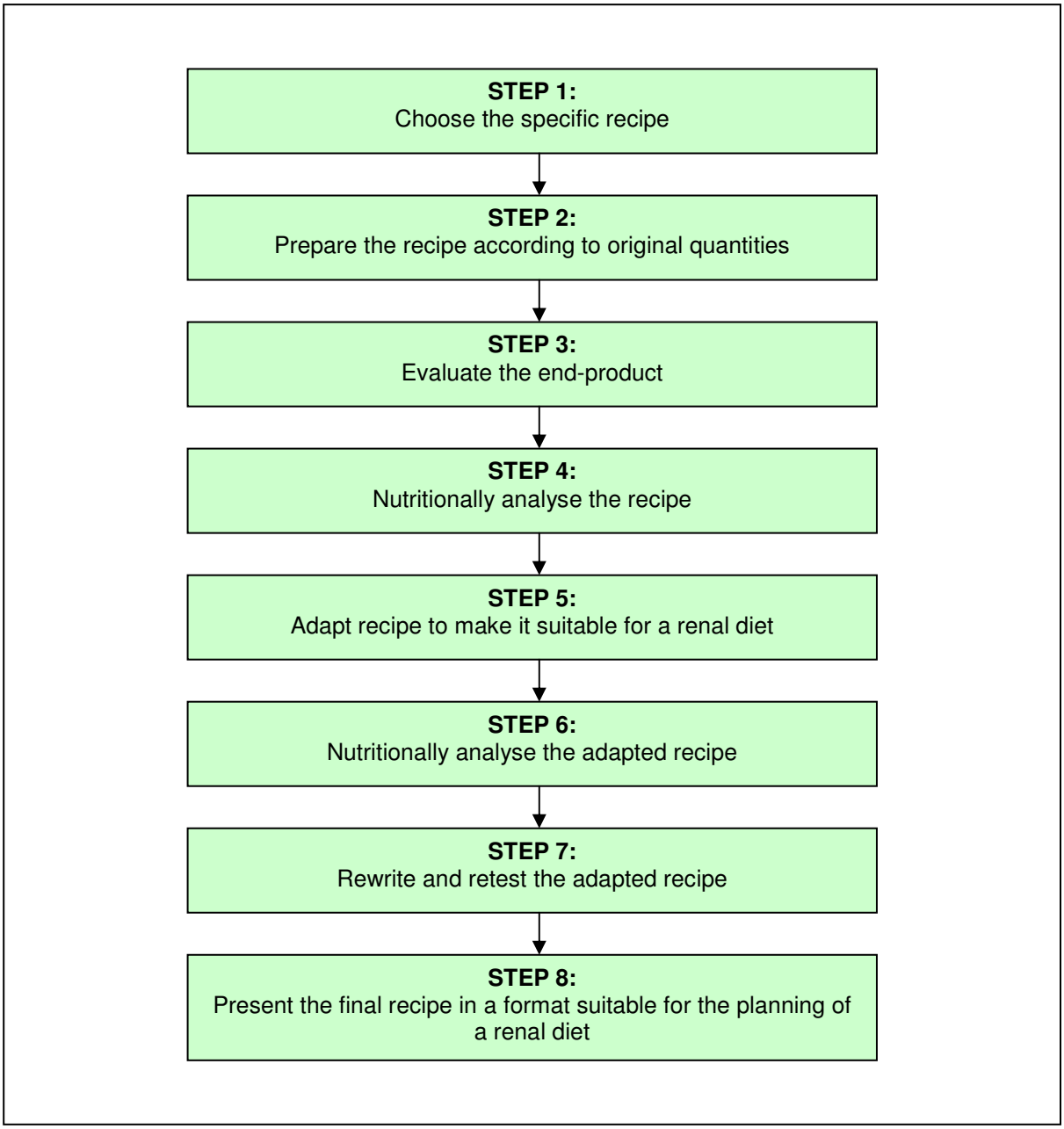


Figure 1.3: Main steps of recipe development [61]

Testing the recipes on the intended target population, during Step 7 of the recipe development process, is vital. This can only be done via specific sensory evaluation techniques intended for the target population.

1.6 SENSORY EVALUATION OF RECIPES

An integral part of recipe development consists of the sensory evaluation of food products to determine if it is suitable and acceptable for the intended target group. Sensory evaluation consists of several steps i.e. the identification, scientific measuring, analysis and interpretation of the characteristics of a food product as observed by the five senses of sight,

smell, taste, touch and hearing. Different characteristics of food can be evaluated by sensory methods to gain insight into the human perception of these foods.[11] These characteristics include (in the order that they are typically perceived): appearance; odour/aroma/fragrance; consistency and texture; and flavour including aromatics, chemical feelings and taste. However, people experience these characteristics as a jumble of near-simultaneous sensory impressions, and without any training, it is difficult to provide an independent evaluation of each.[62]

1.6.1 Appearance / Colour

Colour is the perception that results from the detection of light after it has interacted with an object. It involves both physical and psychological components. The visual perception of colour arises from the stimulation of the retina by light in greater intensities at some wavelengths than others, in the visible region [380 (violet) to 770 (red) millimicron] of the electromagnetic spectrum.[7]

Furthermore, colour has been defined as the evaluation of radiant energy in terms that correlate with visual perception or as a phenomenon which can be described in terms of hue, lightness, chroma or saturation.[7,63] The perceived hue of an object is the perception of its colour, which results from differences in the absorption of radiant energy at various wavelengths by the object. The lightness of the perceived colour indicates the relationship between reflected and absorbed light with no regard to the specific wavelength involved. The chroma (saturation or purity) of the colour relates to the amount of reflection of light at a given wavelength. It is associated with the degree of difference from neutral grey, indicating how a specific colour differs from grey.[7,63]

In food products the consumer often assesses the initial quality of the product by its appearance and colour. The appearance and colour are thus the primary indicators of perceived quality.[7] Studies have shown that appearance and colour of a product affects the perception of other attributes such as aroma, taste and flavour.[64,65] Other than hue and colour, the sensory properties that can be measured by sight include the depth of colour, brightness, clarity, shine, evenness, size and shape as well as visual consistency and texture.[4] Factors affecting colour assessments of food products include lighting, decoration and portion size/shape as well as any sight defects the panel members may have. Lighting should be uniform in colour and intensity across the entire assessment area. For consumer testing, products should ideally be assessed in similar conditions to those in which they would be eaten. The assessment area should be decorated in neutral colours such as grey or off-white and should be free from colourful distractions and the actual amount of the

product or the shape of the portion should be uniform for consistency of results. Sight defects that may influence the evaluation of appearance and colour include colour blindness and night blindness.[4]

1.6.2 Odour / Aroma / Fragrance

Odour stimuli affect only a small area of receptor cells located in the ceiling of the inner nose. This area contains millions of nerve endings of the olfactory nerves. Each nerve ending has at its tip, several fine cilia-like hairs, containing the ultimate olfactory receptors which perceive the odourant and send an electrical impulse to the brain.[4,62,63] However, during normal breathing, only a small amount of air enters this region. Vigorous sniffing will bring a surge of air and odours into the olfactory region. It is recommended that panel members should take three quick sniffs to get the odours high up into the nose. Odours can also enter the region via the mouth, when food is swallowed.[4,63] It is however important to note that some odourants have a pungent component that can cause pain and therefore, at the beginning, each sample must be smelled very carefully. Only when no odour can be perceived, should the sample be sniffed three times. More than three times is not recommended, as this might cause fatigue and adaptation. During odour evaluations it is necessary for the substance to be at least partly soluble, so that it can dissolve in and travel across the mucous layer covering the olfactory receptors.[4,63]

Factors affecting smell assessments include location, health, volatility and any smell defects the panel member may have. The area of assessment should ideally be free from smells because one odour may have an effect on the perception of other odours. Colds and blockages of the respiratory system will also affect the perception of odours as well as additional factors such as hunger, mood, female menstrual cycle and concentration. Temperature and humidity influences the strength of an odour and samples should therefore be served at the temperature at which they are to be normally served or used.[4] Smell defects that may influence smell evaluation include anosmia and specific anosmia.[4,7]

1.6.3 Taste

Specialised sense organs on the tongue and soft palate contain the receptors for the sense of taste,[7] which is a result of the effect of water-soluble molecules interacting with these receptors. These receptors contain taste buds that are renewed every six to eight days. Taste substances are received onto the membranes of those cells containing taste buds, which then transmit an impulse to the brain.[4] The taste buds themselves are contained in specialised structures consisting of bumps and grooves on the tongue. The upper surface is covered with small cone-shaped filliform papillae, on the front and edges of the tongue are

the fungiform papillae, along the sides of the tongue are the foliate papillae and the circumvallate papillae are arranged in an inverted-V on the back of the tongue. Any one of the four classical taste qualities (sweet, sour, bitter, salty) can be perceived on any area of the tongue.[4,7] Saliva also plays an important part in taste function – as a carrier of sapid molecules to receptors and because it contains substances capable of modulating taste response.[7] During taste evaluation, an untrained panel member should be able to recognise the four classic taste qualities and should also be able to associate the correct taste description with a range of common taste compounds. However, differentiating the sensation and meaning between sour and bitter often proves difficult.[4]

When tasting liquids, it is recommended that panel members take small sips of solutions and keep them in their mouths for 2 to 3 seconds. A gap of at least 15 seconds between evaluations should be allowed. With solids, it is more difficult to give rigid guidelines because individuals have different chewing and swallowing behaviour. It is thus advisable to let panel members eat in their own style. A suitable recovery period between evaluations should however be observed.[4] Adaptation to and fatigue of the four classic taste qualities can occur, although it varies considerably.[7,63]

Other factors affecting taste assessments include genetic predisposition and smoking. Adaptation is the physiological change that the taste buds undergo on repeated exposure to a specific stimulus. Fatigue places a limit on the maximum number of assessments that can be done before the quality of information starts to deteriorate. The greater the number of sensory attributes to be evaluated and the greater the strength of the flavours, the quicker the panel member will become fatigued. People with a greater than normal number of taste buds are called “supertasters”. If a panel member is a “supertaster”, this can most definitely affect taste assessments. Smoking does not seem to impair panel members’ performance with respect to basic tastes, but a reasonable time interval should be allowed to lapse before sensory assessment. Taste defects that may influence taste evaluation include ageusia and hypogeusia. The effects of disease and certain drugs can also play a role.[4]

1.6.4 Texture

The texture of an object is perceived by the senses of sight (visual texture), touch (tactile texture) and sound (auditory texture).[7] Texture plays an important role in the overall acceptance of a food product. Consumers have certain expectations of a product regarding texture. If the food product does not live up to these expectations, then a loss of enjoyment can be experienced. Texture is therefore one of the major criteria used by consumers to assess the quality and freshness of foods.[4,63]

A number of sensory systems are involved in textural perception including touch, sight and hearing. All play an important role, although touch has the most important role in food texture, especially mouthfeel.[4] A classification scheme for texture was developed in 1963 by Szczesniak and is still widely used today.[4,7,63,66]

The scheme divided texture into three main groups:

- Mechanical characteristics (related to the reaction of food when stress is applied)
    - Primary parameters (hardness, cohesiveness, viscosity, adhesiveness, elasticity)
    - Secondary parameters (gumminess, chewiness, brittleness)
- Geometrical properties (related to size, shape and orientation of particles within the food)
- Other characteristics (related to perception of moisture and fat content)[66]

1.6.5 Flavour

Flavour is perceived through the combination of odour and taste. These are very important attributes of food products which greatly determine their acceptance or rejection.[63] A number of receptors can be involved in flavour perception including the gustatory (taste buds), olfactory, touch, thermal and pain receptors, however, it is mainly the gustatory and olfactory sensations that result in the typical “flavour in the mouth” perception. Flavour perception is a result of a number of steps, starting before ingestion and continuing even after the food has been swallowed. It can be divided into three stages:

- Odour assessment (sniffing food before it enters the mouth)
- Flavour in the mouth assessment (when food is in the mouth)
- After taste assessment (the perceived sensation after a sample has been swallowed)[4]

1.6.6 Individual Differences

Individual physiological and psychological differences between panel members will always exist. Human variation is infinite and therefore the possibilities for difference are also infinite. Factors that can play a role are gender, age, physiological state, genetics and psychology.[4]

1.6.6.1 Gender

Gender in particular can play a role, due to the fact that women tend to have more developed language skills which can help them to communicate what they perceive with their senses. However, the judgments made by female panel members in relation to flavour and odour have been shown to be more inconsistent, possibly due to pregnancy or menstrual cycles.[4]

1.6.6.2 Age

Taste, smell, sound and sight sensitivities can decrease with age. Therefore, the panel members must be representative of the entire population and the elderly (people 65 years of age and older) should also be included.[4] In South Africa, however, the elderly are often excluded from dialysis due to inadequate dialysis facilities and strict selection criteria.

1.6.6.3 Physiological state

Temporary changes such as hunger, fatigue and illness may limit the precision and reliability of sensory results.[4]

1.6.6.4 Genetics

Genetic factors are known to influence individual differences and are likely to influence sensory perception, particularly when it concerns recognition and detection thresholds to substances.[4]

1.6.6.5 Psychological factors

Different psychologically based biases may affect sensory analysis. It is important to try and identify and eliminate or control these whenever possible (Table 1.3).

Table 1.3: Different psychological biases and errors in sensory evaluation [4,62]

Type of error:	Description:
Adaptation	Decrease or change in sensitivity to a stimulus due to short-term overexposure that can lead to temporary reduction in a panel member's sensitivity to a stimulus.
Association effects	The panel member will try to relate the current stimulus perception to a previous experience when the same sensation was encountered.
Distractions	If panel members are distracted in any way during sensory evaluation it will diminish the accuracy of their judgments.
Expectation	When a panel member has previous knowledge of a product, the member may be keen to note a difference in products and expect to find a difference.
Habituation	Loss of sensitivity due to long-term exposure to a sensory stimulus.

Type of error:	Description:
Halo Effect	When more than one question is asked about the quality of a product, there is a possibility that the responses will not be completely independent. Common in untrained panel members.
Influence from other panel members	A panel member can influence the response from other members either verbally or through facial expression.
Leniency	Panel members try to give an answer that they think will make the panel leader happy.
Logical	When panel members believe two or more product attributes are logically linked.
Presentation order	Panel members may perceive the first presented sample to be better in some way.
Stimulus	If panel members know the objectives or reasons for the test, the extra information can influence their responses.

Other psychological factors may include the personality or attitude of the panel member. Some relevant areas of interest include social conditioning, type of personality, motivation and mood.[4]

1.7 SENSORY EVALUATION TECHNIQUES

The central principle for all sensory evaluation is that the test method should be matched to the objectives of the test[7] (Figure 1.4). Sensory evaluation can be divided into two main categories: analytical sensory evaluation and consumer sensory evaluation. Both categories use the same evaluation technique, but differ with regard to the purpose of the evaluation, the problems they address and the composition and training of the personnel/public testing the product.[67]

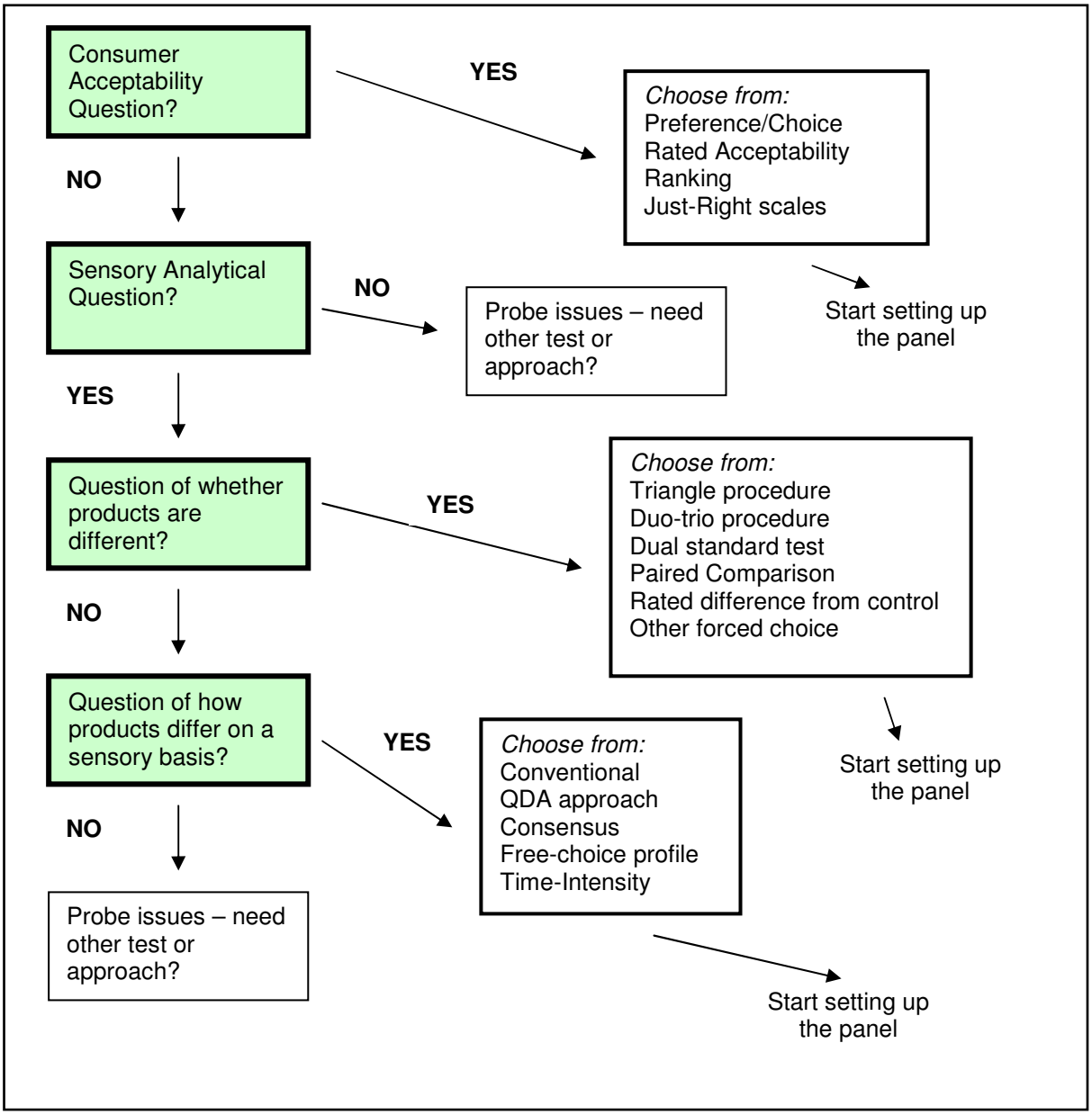


Figure 1.4: Flowchart showing methods for determination of sensory evaluation[7]

1.7.1 Analytical Sensory Evaluation

Analytical sensory evaluation is used in different areas of the food industry for quality control, product development and to correlate the product with objective analysis. Many different types of tests exist for this purpose including discrimination and descriptive tests (Table 1.4). Discrimination or differential testing can be used to determine if there is a perceptible difference or differences between two or more products.[7,67] These tests can be very sensitive in determining small differences between products. Descriptive tests are used to describe the sensory characteristics of a product and to use these characteristics to quantify the differences between products.[67]

Table 1.4: Most common analytical sensory evaluation tests [7,11,62,67]

Discrimination tests include:	Descriptive tests include:
Paired comparison tests	Consensus profiling
Triangle tests	Conventional profiling
Duo-trio tests	Quantitative Descriptive Analysis (QDA)
Ranking tests	Free Choice profiling
	Time-Intensity Descriptive Analysis

For both discrimination and descriptive tests, panel members are selected on the basis of average to good sensory acuity for the characteristics of the product being evaluated. They are familiarised with the test procedures and undergo training to a certain level depending on the method used.[7] The test area and surroundings (including the lighting, air circulation, temperature and humidity) are specifically designed and controlled for the purpose of the sensory evaluation test.[62]

1.7.2 Consumer Sensory Evaluation

Consumer sensory testing, by means of preference or hedonic testing, targets the public or a specific group of individuals to determine the degree of acceptability, preference and sometimes purchasing potential of food products. The specifications and variety of the food is known and the purpose is to study the consumers' response and emotional reactions toward the product.[62] Historically, sensory evaluation of food by consumers represented an important departure from earlier methods based on the opinion of expert tasters.[7] The reasons for conducting consumer tests usually fall into one of the following categories:

- Product maintenance
- Development of a new product
- To improve on an existing product
- To support advertising claims
- Product category review
- To assess market potential[62]

For consumer sensory testing to be effective, the panel should be representative of the target population and should preferably have no, or little, sensory training.[62,67]

In food and consumer products, there are two main approaches to consumer sensory testing: the measurement of preference and the measurement of acceptance[4,7,62] (Table 1.5). In

preference measurement, the panel member must choose one product from one or more products.[7] For acceptance testing the panel member must evaluate the product acceptability or liking.[4,68] The panel members rate their liking for the product on a scale. There are many factors that influence food intake other than acceptance, but acceptability still remains a crucial factor.[69] Acceptance measurements can be done on single products and do not require comparison to another product as with preference measurements.[7]

Table 1.5: Most common consumer sensory evaluation tests [4,7,8,62]

Preference Tests:	**Acceptance tests:**
Paired preference tests	Rating scales
Non-forced preference tests	Just-Right scales
Preference ranking	

1.7.2.1 9 - Point hedonic scale

The rating scale most commonly used in consumer acceptance testing is the nine-point hedonic scale (Figure 1.5), also known as a degree-of liking scale,[7] which determines product acceptance.[8,62,68,69] The scale is very simple to use, and easy to implement, and has been shown to be useful in the hedonic assessment of foods, beverages and nonfood products.[7]

The scale was developed at the Food Research Division of the Quartermaster Food and Container Institute (QMFCI) in the late 1940s.[70] It was initially tested on soldiers in the field, in the laboratory and in attitude surveys. Samples were served to the panel members, one at a time, and they were asked to indicate their hedonic response to the sample on the 9-point scale.[7,70] An untrained panel of at least 50 people can be used for this method, when acceptance of a product is determined for the general public,[67] although smaller groups of up to 35 have been successfully used in previous investigations when the population was small.[71] The scale requires basic reading comprehension skills, visual acuity and perception to see all the words printed on the page, and adequate cognitive ability to scan and comprehend nine items on one page.[69] The test-retest reliability of the scale was determined to be adequate, with no statistically significant differences between the answers from the initial test and the follow-up re-test after two weeks.[7,70,71] The naming of the scale points was addressed during development and it was suggested that the scale should rather begin with “like extremely” than “dislike extremely” although the researchers added that in practice no clear problems resulted from the reverse.[70,72]

Tick the box that best describes your overall opinion of the sample:

☐	Like extremely
☐	Like very much
☐	Like moderately
☐	Like slightly
☐	Neither like nor dislike
☐	Dislike slightly
☐	Dislike moderately
☐	Dislike very much
☐	Dislike extremely

Figure 1.5: Example of the 9-point hedonic scale for consumer sensory evaluation[70]

Despite several concerns regarding the use of the 9-point scale, the scale continues to be a key tool in consumer testing.[68] The scale has the potential to be interpreted differently across cultures[7,73] and some controversy exists regarding the spacing between the intervals.[68] Despite the controversy, it is quite common to assign numerical values to the response choices (1 – 9) when analysing the data from the 9-point scale.[4,7,68] It is also believed that the neutral (neither like nor dislike) category can make the scale less efficient but a neutral response category can be a valid reaction for some consumers. Another concern is that some consumers tend to avoid the extreme categories ('like extremely' and 'dislike extremely') of the scale. Since many scales show "end-use avoidance", it is not recommended to reduce the scale to 7 or even 5 points since this may effectively reduce it further to 5 or 3 useful categories as "end-use avoidance" may still come into play. Changing the scale should thus be avoided as far as possible.[7,8]

Hedonic scaling can also be achieved by using face scales, animal cartoons or pictures of adults. These scales were specifically invented for children and illiterate people, but in many cases, especially with children, it was shown that these scales do not perform well. There is not a great deal of research data available showing the efficacy of these scales on illiterate people.[7]

When using any consumer sensory evaluation technique, factors other than the scale of choice can play a role in the efficacy of the sensory evaluation.[11] Most importantly, sample presentation and preparation should be considered.

1.7.2.2 Sample preparation and presentation

The researcher should be very careful to standardise all serving procedures and sample preparation techniques when doing sensory evaluation experiments.[7] Careful thought needs to be directed towards anticipating all factors that could modify judgment of samples. Reliable data cannot be collected for sensory evaluation if samples differ in any way.[11] Consistency is therefore vital to the successful conduct of experiments. During sample preparation and presentation, attention should be given to the following:

1.7.2.2.1 Serving size

Care must be given to regulate the precise amount of product to be given to each subject. The sample should be delivered in the correct amount with the least amount of handling. Special equipment, such as a scale, can be advantageous for measuring precise amounts of a product.[62] Sample size need not be large for the purpose of sensory evaluation, however a minimum of 15ml for a liquid sample and 30g for a solid sample is recommended.[11]

1.7.2.2.2 Serving containers

Serving containers should be uniform for all samples and for all panel members. Containers should preferably be white or made from glass. In certain circumstances it can be expensive and time-consuming to use glass or porcelain containers and in these cases disposable containers can be used.[7,62]

1.7.2.2.3 Serving temperature

Samples should, as far as possible, be served to panel members at the same specified temperature. The temperature of a sample can greatly affect the sensory evaluation of a product. Products which are normally served warm should be served at a temperature of 65ºC and products normally served cold should be served at a temperature below 10ºC.[74]

Other factors that may have an impact on the sensory evaluation of a sample include the test-room design, location, color and lighting, air circulation, temperature and humidity. However, during consumer sensory testing it can be very difficult to control these factors due to logistical, time and financial constraints.[62] However, these factors are vital to consider when performing analytical sensory evaluation within a laboratory setting.

1.8 PROBLEM STATEMENT AND MOTIVATION FOR THE STUDY

In South Africa there is currently a great demand from dietitians and patients for new and updated recipes, tested specifically on the South African renal patient, and based on the new South African Renal Exchange Lists of 2005.[10] Although recipes for patients with renal failure are available, very few have been developed in South Africa, taking into consideration the diverse cultures and variable needs of patients. Furthermore, recipes developed by other countries often contain ingredients not available in South Africa and are usually based on international exchange lists which differ from the South African renal exchange lists. The few recipes that have been developed in South Africa are out-dated, based on the previous South African renal exchange lists and not on the South African food consumption data. It is thus clear that there is a need to develop and update recipes for the South African patient with renal failure.

Dietitians, with a special interest in renal nutrition from the Division of Human Nutrition, Stellenbosch University, developed a web-based programme that can be used by dietitians for fast, accurate, on-line planning of renal diets. This programme offers a pool of recipes suitable for and tested on renal patients from different cultural / ethnic groups, allowing for the influence of culture on eating habits.

This study was conducted as the first phase in the development and testing of appropriate recipes for the web-based programme's recipe pool. The first phase of the project focused on the development of recipes commonly consumed by those following a westernised diet, determining perceptions of renal patients from a low to middle income group in the Western Cape.

The second phase of the research will focus on the perceptions of Black renal patients following a traditional diet (Eastern Cape). The third phase of the research will focus on the perceptions of Indian renal patients. (Kwazulu-Natal)

CHAPTER 2: METHODOLOGY

2.1 INTRODUCTION

Some deviations in the methodology from the original research protocol were necessary due to practical and logistical reasons and these added significantly to the value of the study. Deviations included, adding secondary objectives and two null-hypotheses, as a result of interesting observations made by the researcher during the data collection period. The sampling method used was also changed.

It was originally planned to perform an observational, descriptive study. After data collection however, the researcher added an analytical component to the study comparing the responses of male and female participants. It was originally planned to exclude black participants due to the fact that the recipes were specifically chosen to target those following a westernised diet. However, after careful consideration, it was decided to include this subgroup due to the possible westernisation of the diet of the black population living in urban areas in South Africa. Another analytical component was then added to the study which compared the responses of the different races. Two secondary objectives and two null-hypotheses were therefore added to the aims and objectives of the study.

Due to circumstances beyond the control of the researcher, non-random quota sampling (as indicated in the research protocol as the method for sample selection) would have delivered a sample size that was too small for the purpose of the study and therefore a census was done instead.

2.2 STUDY OBJECTIVES

2.2.1 Purpose of the study

To develop recipes suitable for the South African patient with CRF following a westernised diet.

2.2.2 Research objectives

2.2.2.1 Main objectives

- To identify and adapt recipes to meet the nutritional requirements of renal patients
- To test recipes by using consumer sensory testing on dialysis patients from Tygerberg Academic Hospital (TAH), Tygerberg, South Africa
- To nutritionally analyse those recipes that meet the specified criteria and rewrite the recipes into a user-friendly format

2.2.2.2 Secondary objectives

- To identify any significant differences between the male and female participants' responses in the consumer sensory testing
- To identify any significant differences in the response of the different races during the consumer sensory testing

2.2.3 Null-Hypotheses

- There is no significant difference between the male and female participants' responses to the consumer sensory testing.
- There is no significant difference in the responses of the different races during the consumer sensory testing.

2.3 STUDY PLAN

2.3.1 Study Design Overview

Study domain: The study domain is in the quantitative domain.

- Quantitative research regarding the sensory evaluation questionnaire and the scoring of the selected recipes.

Study design: Observational, descriptive study with an analytical component.

Study techniques: Consumer sensory testing questionnaire using the 9-point hedonic scale.

2.3.2 Study Population

The study population consisted of patients with CRF on HD and CAPD from TAH.

2.3.2.1 Sample selection

A census was done, including all patients with CRF on dialysis at TAH, Tygerberg, South Africa. Only TAH was included, due to requirements in terms of food safety, transportation, facility and financial reasons. Data was collected during August and September 2008.

2.3.2.2 Sample size

On Mondays, Wednesdays and Fridays an average of forty patients were on HD at TAH during the data collection period. An average of twenty patients were on HD during the morning session between 7am and 12pm as well as during the afternoon session between 12pm and 4pm. All the patients on HD, who were willing to participate, and met the inclusion criteria, were selected for the consumer sensory testing of each recipe. All the available and

willing CAPD patients present in TAH at the time of data collection, who met the inclusion criteria, were also included.

2.3.2.3 Inclusion and exclusion criteria

Inclusion criteria:

- All adult (≥18 and <65 years) HD and CAPD patients
- Literate Afrikaans and English speaking patients (to be able to complete the self-administered questionnaire)
- Patients who were willing to give written informed consent to partake in the study

Exclusion Criteria:

- Patients with diagnosed Diabetes Mellitus

The study was therefore aimed at adult patients with CRF on dialysis and without Diabetes Mellitus, who were able to complete the self-administered questionnaire in either Afrikaans or English and who were willing to give written informed consent to take part in the study.

2.3.3 Methods of Data Collection

Data was collected in three phases as shown in Figure 2.1.

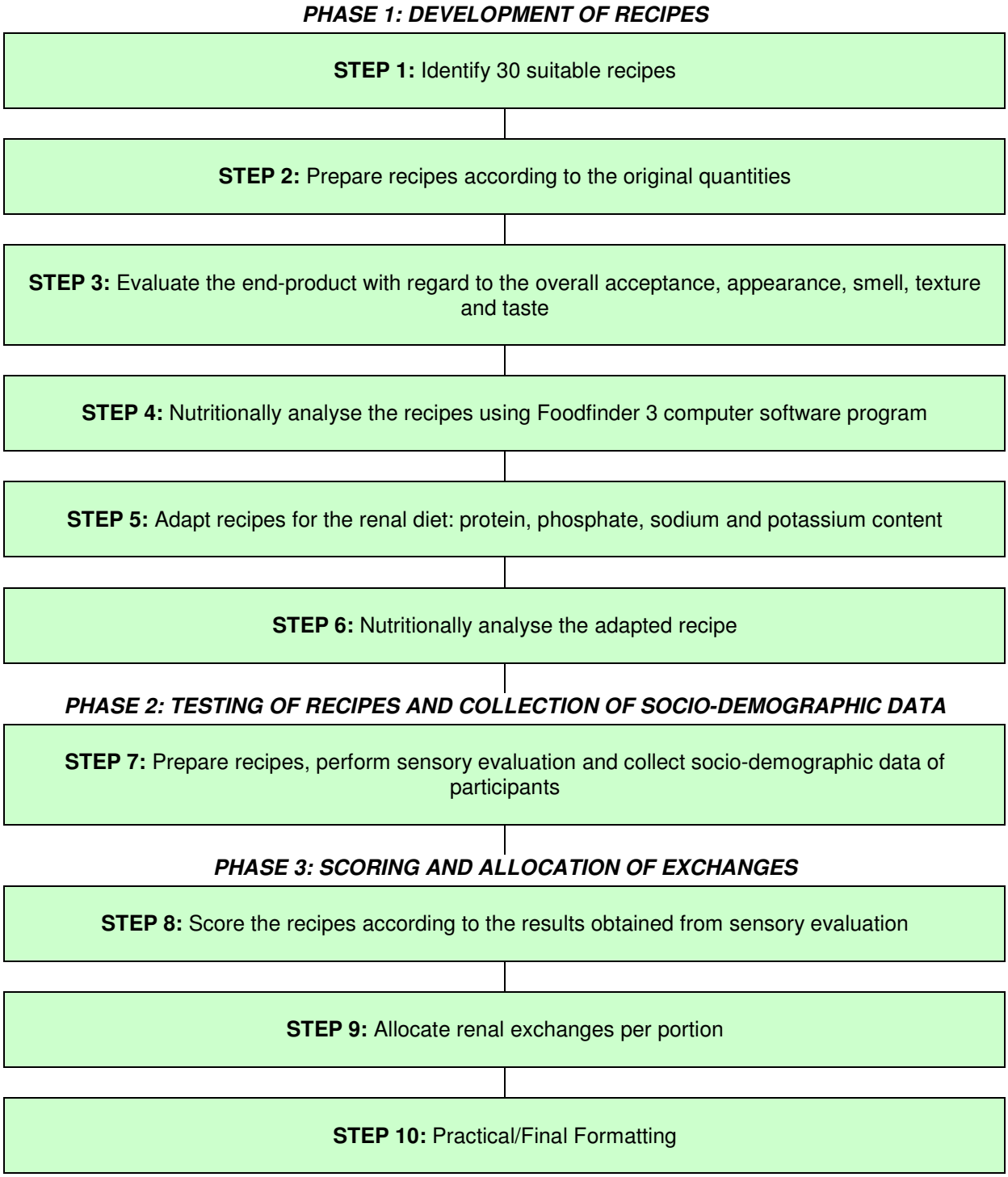


Figure 2.1: Process of data collection

2.3.3.1 Development of recipes (Phase 1)

Step 1:

Thirty suitable recipes commonly consumed by people following a westernised diet were identified. Existing renal recipes that were previously analysed using out-dated renal exchanges, and ordinary recipes from recipe books[75-77] were included. The recipes were categorised into three subgroups: main meals, side dishes and desserts and sweets.

Recipes were chosen to satisfy a variety of appetites and included meat, chicken, pork, fish and vegetarian dishes for the main meals; vegetable- and starch-based dishes for the side dishes and desserts and sweets containing fruits and sugar. The recipes that were included for the development process in Phase 1 are indicated in Table 2.1.

Table 2.1: Recipes included in Phase 1 of data collection[75-77]

MAIN MEALS:	SIDE DISHES:	DESSERTS AND SWEETS:
Bobotie Chicken Pilaf Fish and Vegetable Pie Greenbean Stew Indian Pork Dish Pineapple Chicken Risotto Beef Kebabs Vegetable Lasagna Vegetable Paella	Brussels Sprouts with Tomato and Onion Sauce Cabbage Pot Curried Wheat Salad Greenbean, Pea and Mushroom Salad Peas in Lemon and Mint Sauce Potato Fritters Pumpkin Fritters Rice Salad Vegetarian Mushroom Dish Wheat and Mushroom Casserole	Baked Apple Pudding Baked Apples in Custard Sauce Fruit Jelly Fruit Kebabs Fruit Salad Cinnamon Sugar Pancakes Poached Pears Coconut Ice Date Fingers Marie Biscuit Fudge

Step 2:

Before commencing with Step 2 in the data collection process, the researcher identified a suitably qualified dietitian as research assistant to assist with recipe preparation and data collection. A meeting was held with the research assistant, discussing the aims and objectives of the study as well as the methods of recipe preparation and the procedures to be followed during data collection.

During the period of 30 June 2008 to 4 July 2008, the 30 selected recipes were prepared according to the original quantities and methods as stated in the original recipes. The recipes were prepared by the researcher and the research assistant using household equipment and utensils. Six recipes were prepared each day over a period of five days.

Step 3:

After preparation, the recipes were then evaluated by the researcher and research assistant for overall acceptance, appearance, smell, texture and taste. Recipes were also evaluated for appropriate portion size, weight and total yield by comparing them to the renal exchanges to determine if appropriate. A photograph of each recipe was taken for future reference and to be posted on the Renal Smart website.

Step 4:

All 30 recipes were nutritionally analysed, using the Foodfinder 3 computer software program. If specific ingredients were not available on the Foodfinder 3 program, a suitable alternative with a similar nutritional content was selected to replace that ingredient for the purpose of the analysis.

Step 5:

After evaluating the nutritional analysis of each recipe, according to the original portion size, specific attention was given to the energy, protein, carbohydrate and fat content as well as the sodium, potassium and phosphate content of each recipe. Adaptations were then made to the recipe, as appropriate, to make it suitable for inclusion in a renal diet. These included:

- Decreasing the portion size
- Removing all added table salt (NaCl) from the recipe
- Decreasing the protein content by reducing or omitting the protein-rich ingredients within the recipe
- Decreasing the sodium content by reducing or omitting the sodium-rich ingredients within the recipe
- Decreasing the potassium content by reducing or omitting the potassium-rich ingredients within the recipe
- Decreasing the phosphate content by reducing or omitting the phosphate-rich ingredients within the recipe

Recipes were then rewritten to include all the above-mentioned adaptations.

Step 6:

The 30 recipes were then nutritionally analysed again, using the adapted ingredients and portion sizes. Again, if specific ingredients were not available on the Foodfinder 3 program, a suitable alternative with a similar nutritional content was selected to replace that ingredient for the purpose of the analysis.

2.3.3.2 Testing of recipes and collection of socio-demographic data (Phase 2)

Step 7:

The adapted recipes were tested and evaluated by the study participants during the period of 6 August 2008 to 10 September 2008.

Increasing the yield:

Once the chosen recipes were adapted, rewritten and analysed, the yield of the recipes were increased using the factor method[61] to ensure each participant received a 60g portion of each dish for the purpose of testing.

Obtaining consent from the participants:

HD patients: On the first and second day of sensory evaluation (6 and 8 August 2008) the researcher approached every patient on dialysis who complied with the inclusion criteria to ask for written consent to partake in the study. The consent form (Appendix 6.1 and 6.2) was discussed in detail with each patient, including the purpose of the study and what would be expected of them. Before sensory evaluation could commence, each patient had to give written informed consent. A copy of the consent form was given to the participant for perusal.

The researcher also discussed the sensory evaluation form and explained the scoring on the evaluation form to familiarise the patient with the format. It was explained to the patient that "Like extremely" was the highest possible score to give a recipe, while "Dislike extremely" was the lowest possible score to give a recipe. If the patient felt that he/she did not particularly like or dislike a recipe, a neutral score of "Neither like nor dislike" could be given. It was also explained that any score, from "Dislike extremely" to "Like extremely" could be given, depending on the degree to which the patient like the recipe.

During the course of the data-collection period new patients were started on dialysis. Before they could join the study; written consent was also obtained from them in the same manner as described before.

CAPD patients: The researcher contacted the hospital renal dietitian before every testing day, to establish if there would be any suitable CAPD patients in the hospital on the day of testing who complied with the inclusion criteria. If a patient was identified, the above mentioned procedure was followed to obtain written consent from the patient.

To ensure anonymity, each participant received a unique code number which was used during the capturing of data.

Preparing the recipes:

The adapted recipes were prepared by the research assistant on two weekday afternoons (Tuesdays and Thursdays) in a household kitchen, using household equipment and utensils. Shopping for the recipe ingredients was done on the Tuesday and Thursday mornings at

local supermarkets and fruit and vegetable markets to ensure the freshest possible produce. Three dishes were prepared at any one time, including a main meal, a side dish and dessert/sweets. After preparation, the dishes were refrigerated overnight in sealed plastic containers. The following morning, the dishes were transferred to a cooler box to maintain the cold chain, and transported to TAH.

Pre-preparation in TAH kitchen and the ward kitchen before sensory evaluation:
According to the protocol, the sensory evaluation of three recipes should have been performed every Wednesday and Friday, in the morning and afternoon, during the data collection period between 6 August 2008 and 10 September 2008. However, in some instances, the evaluation of two or four recipes was done on one day, due to logistical and practical reasons. Although patients received dialysis on Mondays as well, it was decided to exclude Mondays due to logistical reasons (food would have been prepared over the weekend).

On arrival at TAH (at approximately 8am) and after lunch time (at approximately 1pm) the researcher and/or research assistant re-heated half of the portions of each dish in the TAH kitchen. Only dishes that are normally served hot were re-heated in oven-proof containers to reach an internal temperature of 74ºC for 15 seconds to ensure microbial safety.[74] Cold foods were served at a temperature below 10°C. Permission was obtained from the chief director of TAH and the food service manager of the main kitchen to use one oven and a working surface in the main kitchen for preparing the samples.

A 60g sample of each recipe (main meal, side dish and dessert/sweet) was portioned and placed in a white foamolite container. At approximately 9am and 2pm, respectively, the researcher and/or research assistant transported all the prepared samples on the ward trolley via a hospital lift to the dialysis unit.

On arrival at the dialysis unit, the trolley was taken to the ward kitchen where the food samples were removed from the trolley and placed on trays for the patients, together with a disposable knife, fork or spoon depending on the type of dish.

Sensory evaluation of the recipes:
Each patient, who had given consent and did not feel ill or nauseous on the day of the evaluation received all the samples to be tested on the day simultaneously. A serviette, glass of water, a pen and two/three/four sensory evaluation forms were also provided (Appendix 6.3 and 6.4) – one for each recipe tested on that day. The sensory evaluation forms were

pre-coded according to the participants' reference numbers and the date and recipe name were indicated on the form. The patients then proceeded with the sensory evaluation of the recipes, always starting with the main meal/s, followed by the side dish/es and the dessert/s or sweets. The patients completed the sensory evaluation forms themselves and returned them to the researcher or research assistant who was always available for any possible questions or queries. This procedure was followed every morning and afternoon on Wednesdays and Fridays for the full duration of the data collection period.

Collection of socio-demographic data

The age, gender and race of all participants were collected from the patient files, by the researcher, on the last day of sensory evaluation on the 10th of September 2008.

2.3.3.2.1 Description of the consumer sensory testing questionnaire

In the questionnaire (Appendix 6.3 and 6.4) the patients were given basic instructions on how to perform the sensory evaluation test – such as rinsing their mouths with water before tasting. They were asked to comment on several aspects including: overall acceptance, appearance, smell, texture (mouth feel) and taste. They rated every question on a 9-point hedonic scale ranging from "Like extremely" to "Dislike extremely". The participants used a separate form for each recipe.

2.3.3.3 Rating of recipes and allocation of renal exchanges (Phase 3)

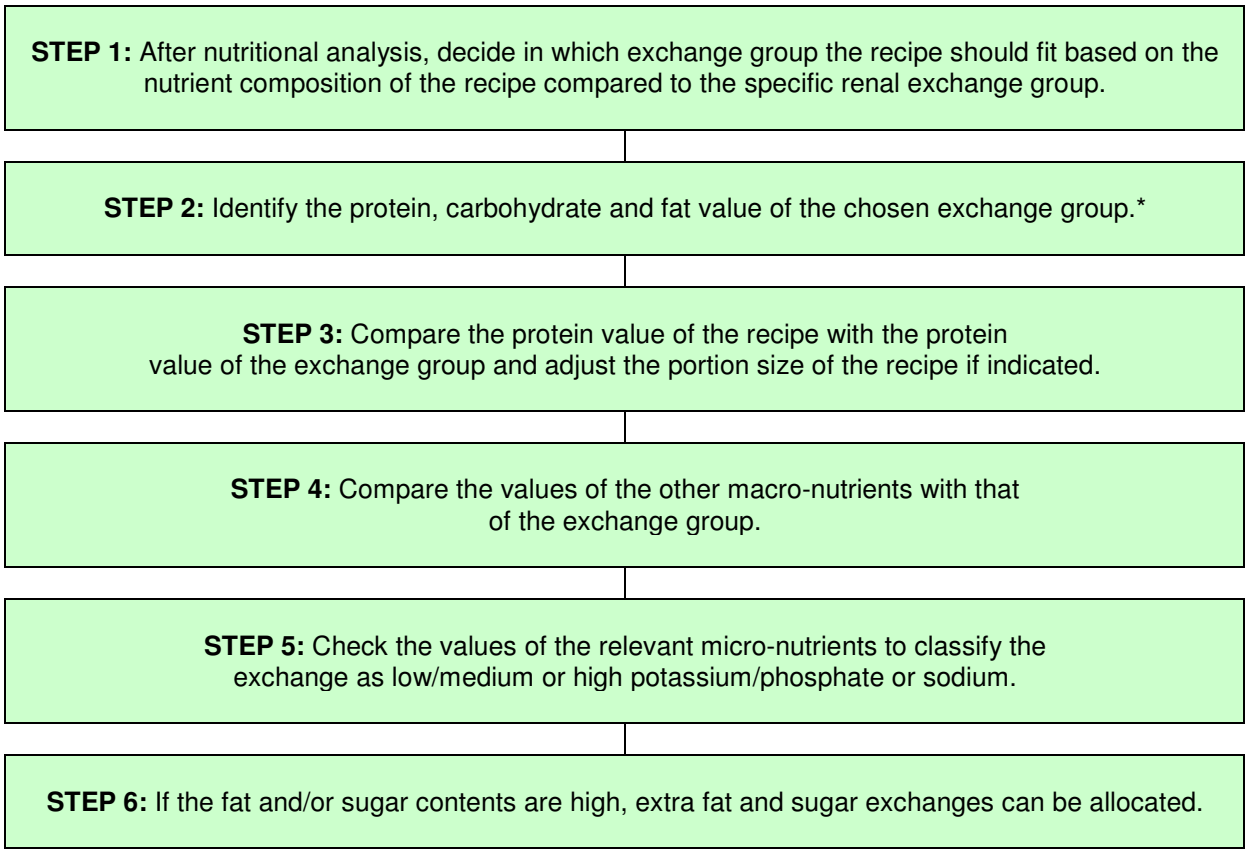
Step 8:

After completion of the sensory evaluation of 30 recipes, the researcher identified those recipes deemed acceptable by the study participants. Ordinal values were assigned to the response choices of the participants for each recipe based on previous studies.[4,7,68] A score of 1 was given if a participant ticked the box "Dislike extremely", while a score of 9 was given if a participant ticked the box "Like extremely". Therefore, a score of 1 - 9 was given for each recipe tested by every participant. Only those recipes that received an overall average score of 6 (Like slightly) or higher on all characteristics by more than 80% of the study population, were included. These values were selected arbitrarily due to a lack of clear guidelines in the literature. According to research by Herselman *et al*, who also developed recipes suitable for patients with CRF, the cut-off point for acceptability was 4 on a 7-point scale, where 80% of the participants had to give a score of 4 or more.[78]

Step 9:

The researcher determined the number of exchanges – per portion – of each acceptable recipe, using the new South African Renal Exchange lists[10] to assist renal patients, when

they want to include a portion of a recipe as part of their diet. The procedure of allocating renal exchanges to a recipe is indicated in Figure 2.2.



* Only use full exchanges as far as possible.

Figure 2.2: Procedure followed in the allocation of renal exchanges to a recipe

Step 10:

After allocating renal exchanges to a portion of each recipe, the researcher completed the final formatting of each recipe. The main aim was to present the recipe in a user-friendly format that was easy to follow and understand, in accordance with the Renal Smart format. Each recipe contains the total yield, portion size, ingredients, and steps in preparation as well as the number of exchanges per portion.

2.3.3.4 Validity and reproducibility of the data collection tool

2.3.3.4.1 Face Validity

The pilot study to determine the face validity of the consumer sensory testing form was done in June 2008. On the 27th of June 2008, one recipe was prepared by the research assistant. On the 28th of June 2008, a 60g sample of the recipe was tested and evaluated, using the consumer sensory testing questionnaire. Using convenience sampling, the researcher

selected five patients without diagnosed CRF from a general ward in TAH, to take part in the pilot study.

The five patients consisted of 3 females and 2 males. Four of the participants were coloured, while 1 participant was white. Patients from a general ward from the same hospital were chosen, due to the fact that they come from the same socio-economic and cultural background as the patients in the dialysis unit. Patients on dialysis in TAH were not used for the pilot study due to the already small number of potential study participants.

After giving written consent, the patients were asked to test and evaluate the recipe and then give feedback regarding the problems they experienced while completing the sensory evaluation form and using the 9-point hedonic scale.

Two problems encountered on the sensory evaluation form were addressed by the researcher after comments from the patients:

- The patients did not understand the word “texture” and therefore a description of the word was given next to the word in brackets i.e. mouth-feel.
- All five scales for appearance, smell, texture, taste and the overall characteristics were included on one page and this confused the patient as two scales appeared next to each other. This was then changed by the researcher so that the scales followed one another over two pages.

2.3.3.4.2 Reproducibility

The test-retest reliability of the scale was previously determined to be adequate, with no statistical significant differences between the answers of the initial test and the follow-up re-test after two weeks. Specific statistical values were not available for the test-retest reliability from the original article.[7,70,71] Testing the reproducibility of the 9-point-hedonic scale was considered beyond the scope of this study due to the magnitude of factors that could influence the accuracy of such a reproducibility study. Difficulties in reproducing the exact conditions in which testing occurred include, possible taste changes that may occur over time, medication that may affect taste, patient health, mood and environmental factors that cannot be controlled in a hospital setting.

2.4 DATA ANALYSIS

2.4.1 Preparation and Analysis of Data

Data sheets were prepared in Microsoft Excel[80] with all variables listed in columns with one title row and the entries for the different respondents entered in rows. A statistician appointed by the Faculty of Health Sciences, University of Stellenbosch, was consulted for the analysis of the data.

2.4.2 Statistical Methods

Mainly descriptive statistics such as frequency tables, means, standard deviations, medians and quartiles of ordinal data were used. Variables were presented graphically in the form of histograms to show the nature of the distribution of the particular variables and to identify possible outliers. The means of applicable subgroups are also presented in tables with comparative measures like ANOVA or Mann Whitney tests. The Mann Whitney tests are appropriate since the measurements for each group is not normally distributed. The STATISTICA 8.0 Software programme was used for the statistical analysis.[80]

2.5 ETHICS AND LEGAL ASPECTS

2.5.1 Ethics Review Committee

A protocol for the proposed study was submitted to, and subsequently approved by the Committee for Human Research, Faculty of Health Sciences, University of Stellenbosch. (NO7/10/220: 12/11/2007; Appendix 6.5)

2.5.2 Informed consent

The renal patients from TAH were provided with an informed consent form (Appendix 6.1 and 6.2), which was adapted from the standard informed consent form used by the Faculty of Health Sciences, University of Stellenbosch. Participants received a copy of the consent form upon signing the form.

It was explained to each participant that signing of the form would imply the following:

- Participation was entirely voluntary.
- Participants were allowed to withdraw from the study at any time.
- Consent was given for the sensory evaluation of all 30 recipes tested from 6 August 2008 to 10 September 2008.
- The participant consented to information, which was gained from the sensory evaluation form, being used for research purposes.

2.5.3 Patient Confidentiality

Any personal identification information was omitted from the study to ensure confidentiality. Upon entering the study, each participant received a unique identification number that was used on all study-related material. The participants were ensured of confidentiality via the consent form. Data was also captured blind, using the unique identification number.

2.6 SPONSORSHIP

The researcher applied for sponsorship from various sources, including companies from the food industry, to cover expenses. The researcher obtained sponsorship from The Harry Crossley Foundation and the Nestlé Nutrition Institute Africa (NNIA) to conduct the study. The researcher also received a grant for temporary research assistance from the University of Stellenbosch.

CHAPTER 3: RESULTS

3.1 PARTICIPANT DEMOGRAPHICS

In total, 45 patients who complied with the inclusion criteria gave written informed consent to take part in the study. None of the patients refused to take part, while one patient was excluded from the study population as he had diagnosed Diabetes Mellitus. And none was excluded due to illiteracy.

Of the 45 participants, 80.00% (n=36) were coloured, 15.56% (n=7) were black, while only 4.44% (n=2) were from the white population. An almost equal gender distribution of females and males, 51% (n=23) and 49% (n=22) respectively, took part in the study (Figure 3.1).

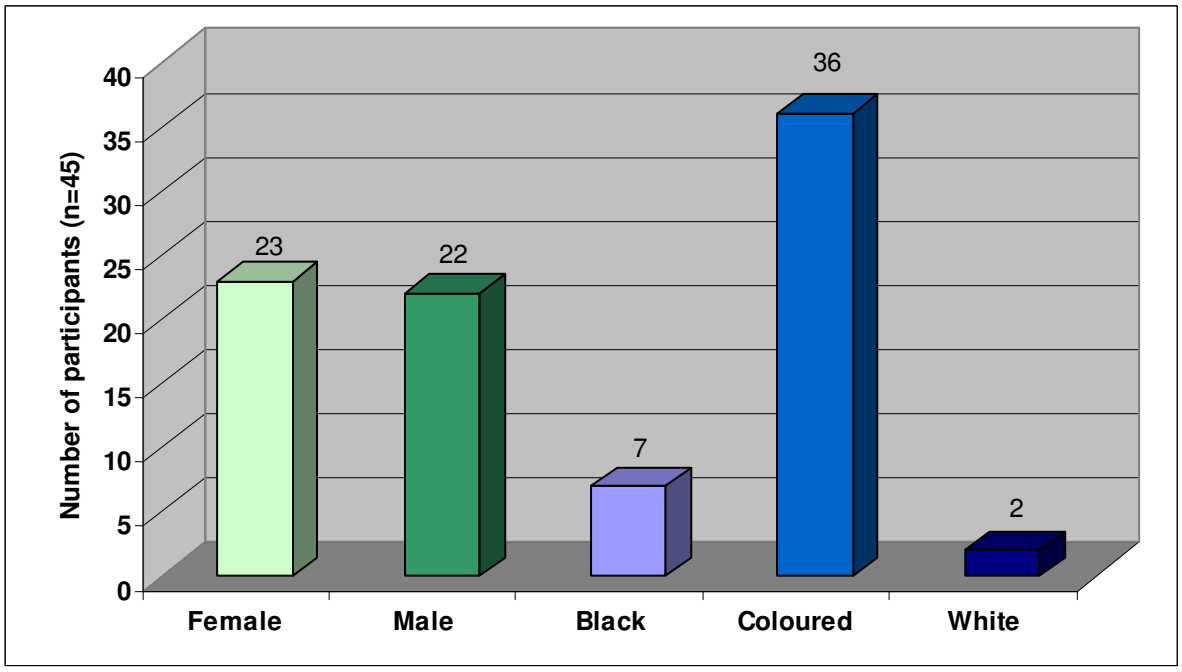


Figure 3.1: Gender and race distribution of participants

The mean age of all participants was 39.11(SD±8.32) years, with 44.44% (n=20) falling within the 40 to 50 year category. Ages ranged from 19 to 53 years of age, with only 11.11% (n=5) participants older than 50 years. The age distribution of the participants is shown in Figure 3.2.

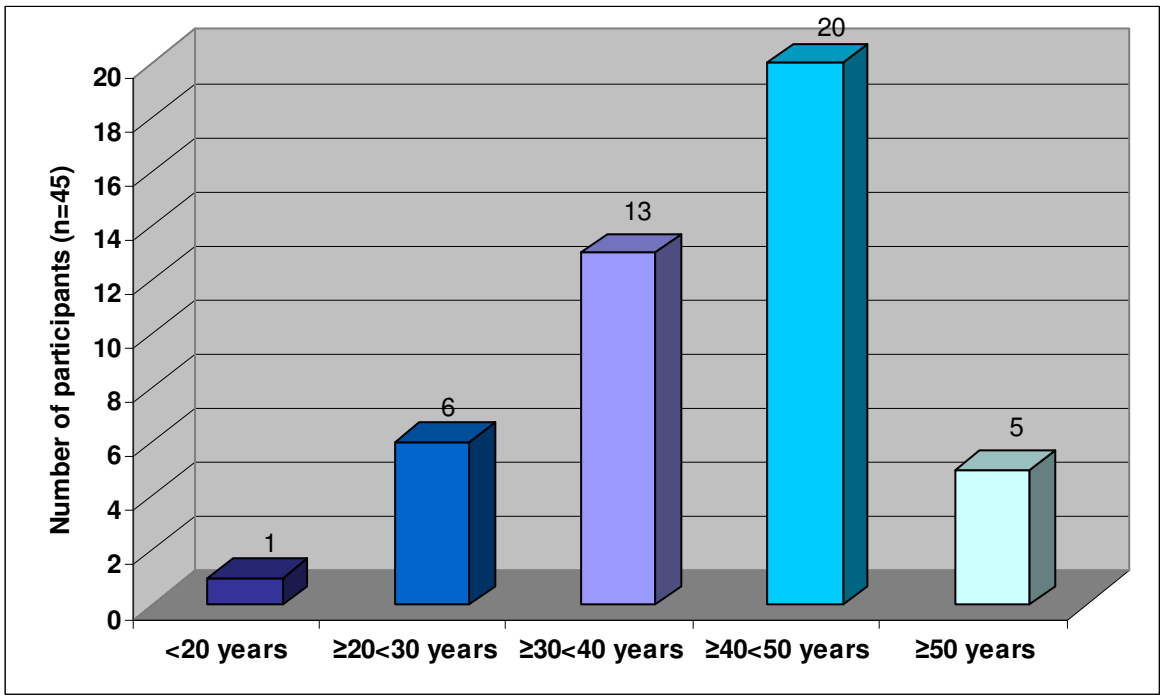


Figure 3.2: Age distribution of participants

On the different days of recipe testing, patients who had already given consent to take part in the study, refused to take part in the sensory evaluation for various reasons, including: feeling too ill and being very nauseous on that day. On several testing days some of the participants were absent and could therefore not take part in the testing of the recipes for that day. The total number of participants present for every sensory evaluation as well as the gender and race distribution of the participants is indicated in Table 3.1. It is important to note, that on several occasions no white participants took part in the sensory evaluation, while on one occasion a patient did not take part in the sensory evaluation of a recipe (Indian Pork dish) due to their religious beliefs.

Table 3.1: Total number of participants present per recipe tested

Testing day	Recipes tested	Total number of participants (n)	Gender distribution M = Male F = Female	Race distribution B = Black C = Coloured W = White
1 6/08/08	Pumpkin Fritters Date Fingers	35 35	17 M 18 F	6 B 27 C 2 W
2 13/08/08	Risotto Greenbean, Pea and Mushroom Salad Fruit Jelly	35 35 35	16 M 19 F	5 B 29 C 1 W
3 15/08/08	Pineapple Chicken Rice Salad Coconut Ice	36 36 36	16 M 20 F	7 B 28 C 1 W
4 20/08/08	Indian Pork Dish	32	14 M 18 F	6 B 26 C 0 W
4 20/08/08	Wheat and Mushroom Casserole Fruit Kebabs	33 33	15 M 18 F	7 B 26 C 0 W
5 22/08/08	Bobotie Cabbage Pot Marie Biscuit Fudge	35 35 35	14 M 21 F	7 B 28 C 0 W
6 27/08/08	Beef Kebabs Vegetarian Mushroom Dish Fruit Salad	34 34 34	15 M 19 F	4 B 30 C O W
7 29/08/08	Vegetable Lasagna Peas in Lemon and Mint Sauce	37 37	16 M 21 F	7 B 30 C 0 W
8 3/09/08	Vegetable Paella Potato Fritters Cinnamon Sugar Pancakes Poached Pears	34 34 34 34	15 M 19 F	6 B 27 C 1 W

Testing day	Recipes tested	Total number of participants (n)	Gender distribution M = Male F = Female	Race distribution B = Black C = Coloured W = White
9 5/09/08	Fish and Vegetable Pie Brussels Sprouts with Tomato and Onion Sauce Baked Apple Pudding	35 35 35	15 M 20 F	7 B 28 C 0 W
10 10/09/08	Chicken Pilaf Greenbean Stew Curried Wheat Salad Baked Apples in Custard Sauce	35 35 35 35	16 M 19 F	7 B 28 C 0 W

3.2 CONSUMER SENSORY TESTING

Due to the very small number of white participants taking part in the study, the white and coloured participant subgroups were combined, for the purpose of data analysis, to form one subgroup named the “westernised” group.

3.2.1 Overall Acceptability Scores for Main Meals

Patients were asked to rate the overall acceptability of each recipe using the 9-point hedonic scale. For the main meals, a summary of the overall scores is shown in Figure 3.3. The overall score for acceptability for all subgroups combined, showed that the *Pineapple Chicken* scored the highest with a score of 8.11(SD±0.95) while the *Risotto* scored the lowest with a score of 6.77(2.28). Other popular dishes included the *Bobotie* and the *Indian Pork Dish* with scores of 7.94(1.19) and 7.88(1.04) respectively, while the *Fish and Vegetable Pie* had the second lowest score of 6.86(2.00).

However, while the males preferred the *Pineapple Chicken* with a highest overall score of 8.06(0.85), the females preferred the *Chicken Pilaf* with a highest overall score of 8.21(2.23). There was a significant difference between the overall acceptability scores of the males and females for the *Fish and Vegetable Pie* (p=0.031) and the *Chicken Pilaf* (p=0.008), with the females showing a greater preference for these two dishes than the males.

Black participants preferred the *Indian Pork Dish* [8.33(0.82)], while the westernised subgroup preferred the *Pineapple Chicken* [8.28(0.84)]. There were no significant differences in the overall acceptability scores between the westernised and the black subgroups. All the

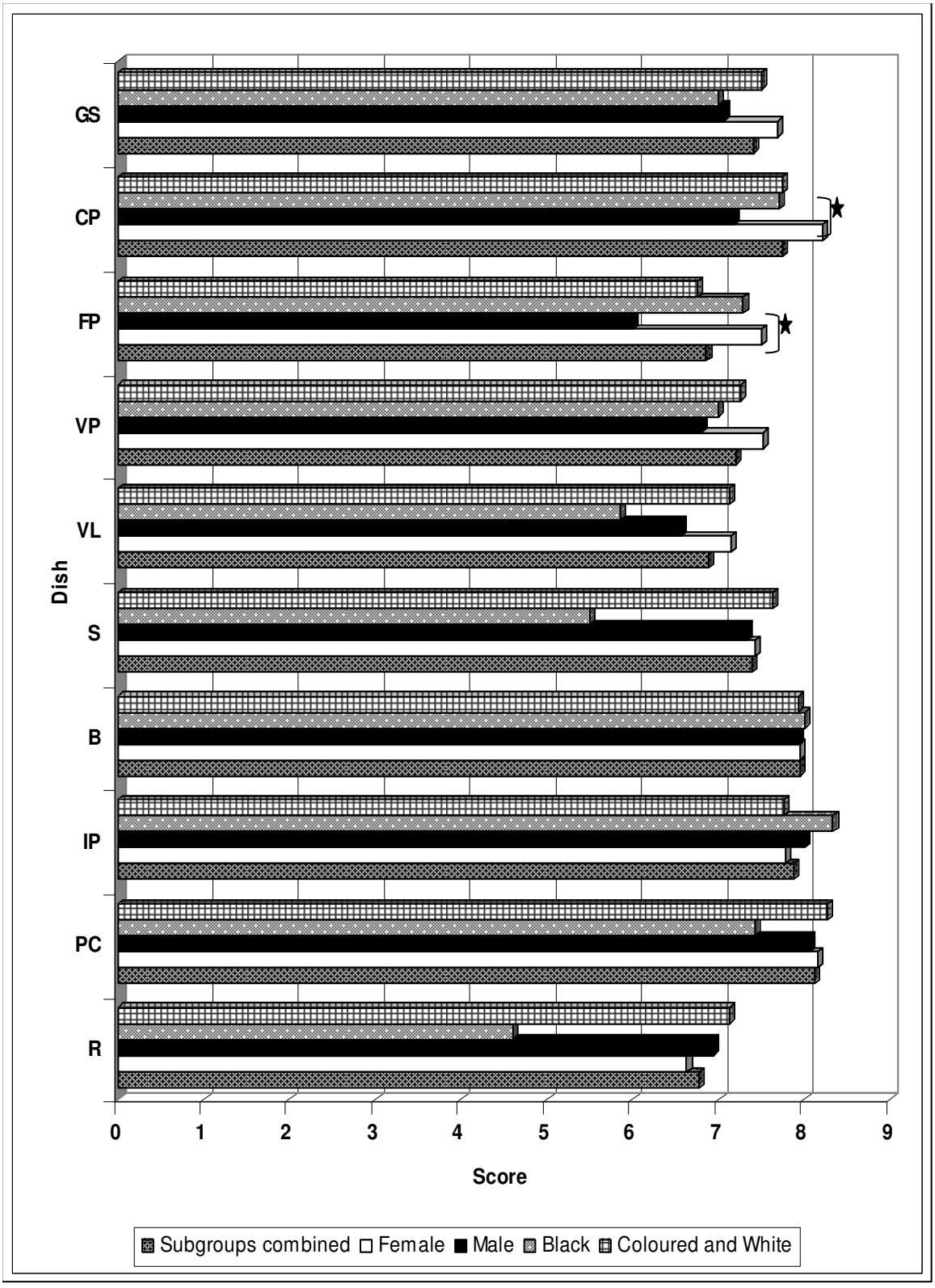
main meals tested received an overall acceptability score above 6 for the subgroups combined.

3.2.2 Overall Acceptability Scores for Side Dishes

A summary of the overall acceptability scores of the side dishes is shown in Figure 3.4. The overall score for acceptability for all subgroups combined indicated that the *Vegetarian Mushroom Dish* scored the highest [7.74(1.50)] and the *Rice Salad* second highest [7.58(1.66)]. The *Greenbean, Pea and Mushroom Salad* and the *Wheat and Mushroom Casserole* had the lowest scores [4.29(2.57) and 4.76(2.12) respectively].

Men preferred the *Vegetarian Mushroom Dish* [7.87(1.25)] and the *Rice Salad* [7.50(1.51)]. Females also preferred the *Rice Salad* [7.65(1.81)], and the *Vegetarian Mushroom Dish* [7.63(1.71)]. The westernised subgroup preferred the *Rice Salad* [8.07(0.92)], while they rated the *Greenbean, Pea and Mushroom Salad* [4.27(2.65)] lowest. Interestingly, there were no significant differences between the overall scores of the males and females. There was a significant difference between the overall scores of the black and westernised subgroups for the *Rice Salad* ($p=0.006$), *Wheat and Mushroom Casserole* ($p=0.022$) and the *Curried Wheat Salad* ($p=0.043$) with the westernised subgroup showing a greater preference for these dishes than the black subgroup.

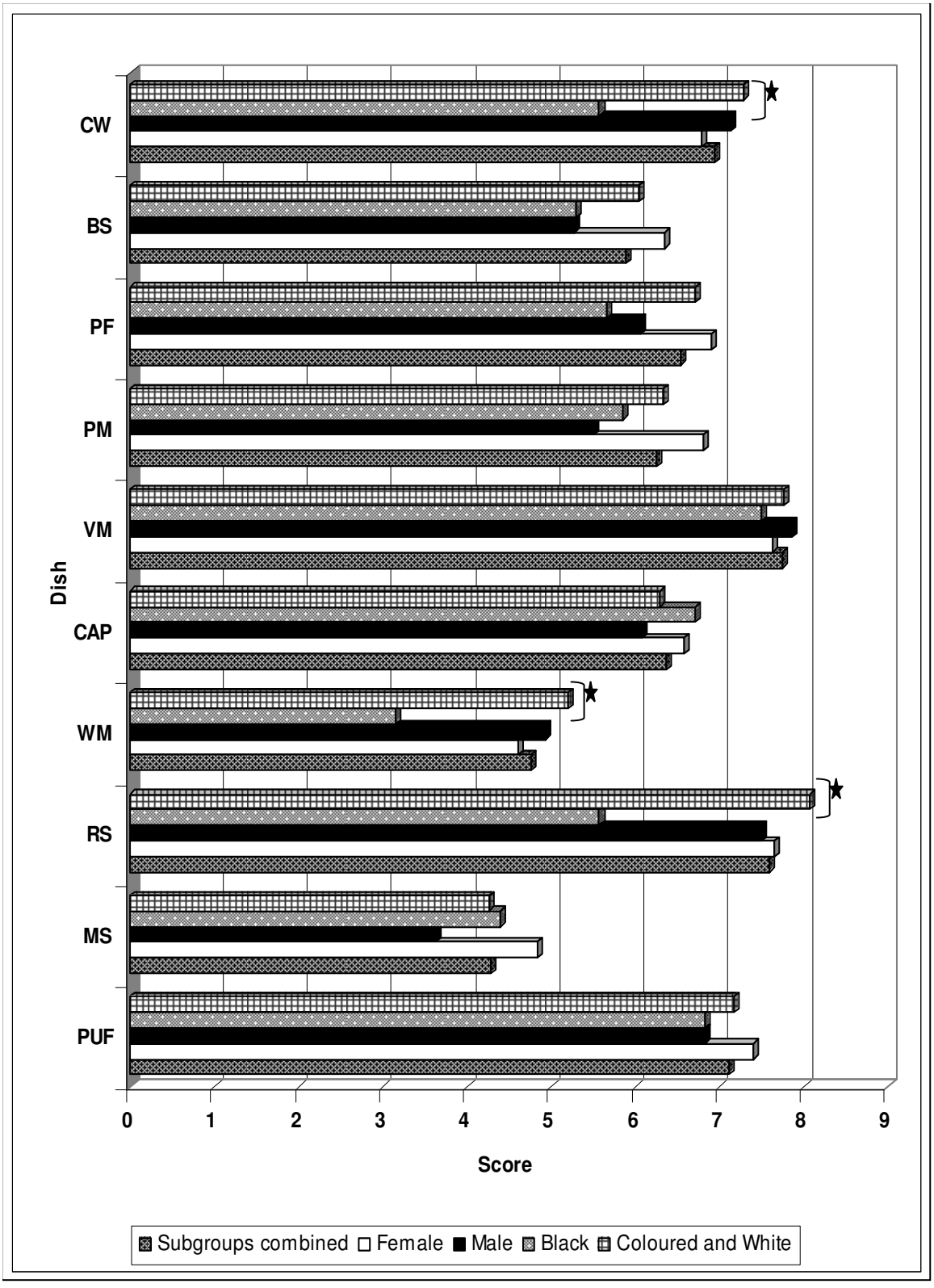
All the side dishes evaluated received an overall acceptability score, for all subgroups combined, above 6.24 except for the *Greenbean, Pea and Mushroom salad*, *Wheat and Mushroom Casserole* and the *Brussels Sprouts with Tomato and Onion Sauce* scoring below 6.00.



* Significant difference ($p<0.05$)

Figure 3.3: Overall Scores – Main Meals

Abbreviations: GS: Greenbean Stew; CP: Chicken Pilaf; FP: Fish and Vegetable Pie; VP: Vegetable Paella; VL: Vegetarian Lasagna; S: Beef Kebabs; B: Bobotie; IP: Indian Pork Dish; PC: Pineapple Chicken; R: Risotto



* Significant difference ($p<0.05$)

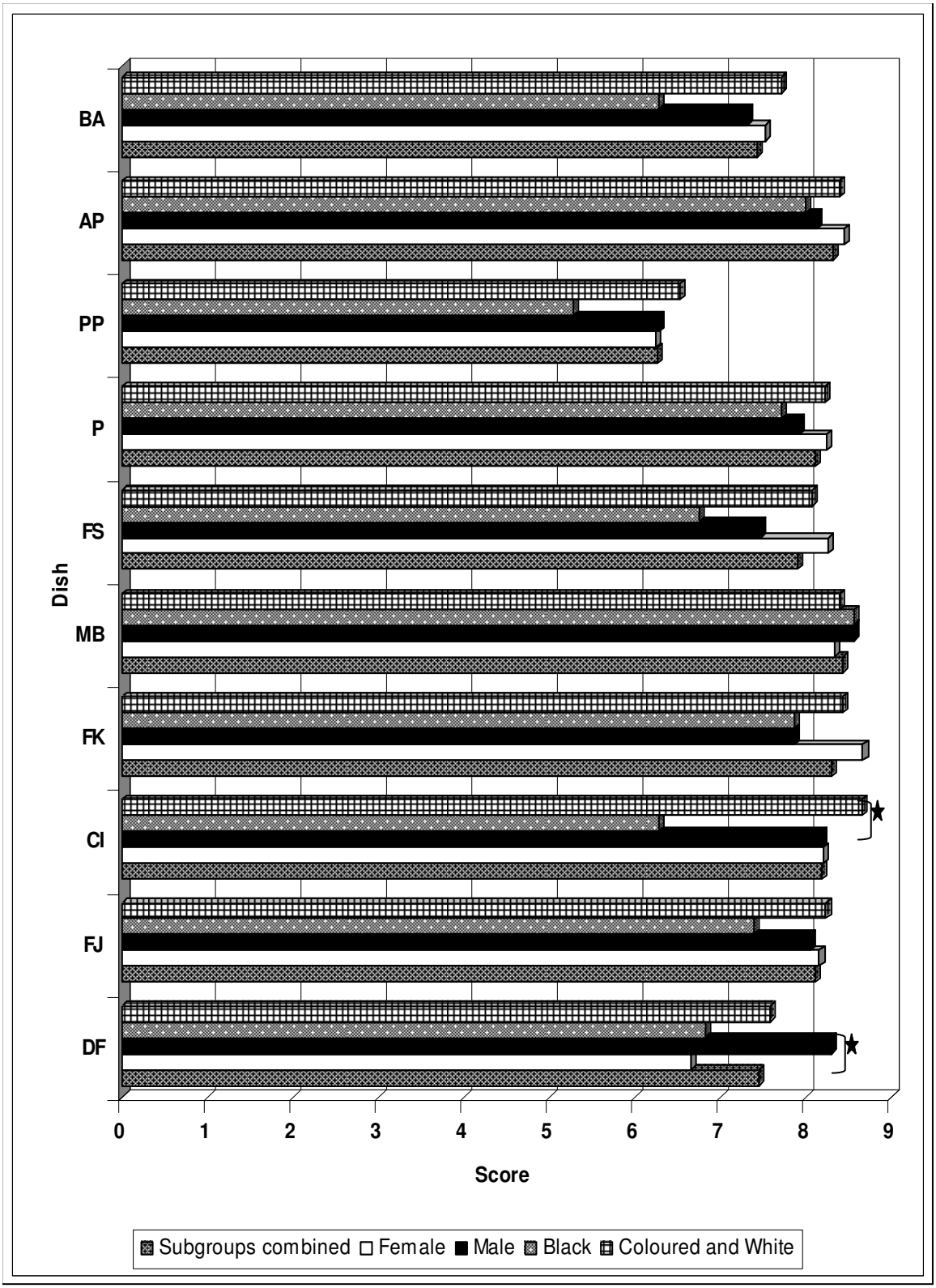
Figure 3.4: Overall Scores – Side Dishes

Abbreviations: CW: Curried Wheat Salad; BS: Brussels Sprouts in Tomato and Onion Sauce; PF: Potato Fritters; PM: Peas in Lemon and Mint Sauce; VM: Vegetarian Mushroom Dish; CAP: Cabbage Pot; WM: Wheat and Mushroom Casserole; RS: Rice Salad, MS: Greenbean, Pea and Mushroom Salad; PUF: Pumpkin Fritters

3.2.3 Overall Acceptability Scores for Desserts and Sweets

For the desserts and sweets, a summary of the overall acceptability scores is shown in Figure 3.5. The overall acceptability score for all subgroups combined, as well as the male and black subgroups, indicated that the *Marie Biscuit Fudge* scored the highest [8.43(1.07), 8.57(0.65) and 8.57(0.53) respectively]. The *Fruit Kebabs* scored the second highest overall with 8.30(1.13) with the females [8.67(0.49)] preferring this dessert. The westernised subgroup preferred the *Coconut Ice* [8.66(0.69)]. All participant subgroups gave the lowest score to the *Poached Pears* dessert, with scores ranging from 5.29 and 6.52 and a combined overall score of 6.26(2.02).

There was a significant difference between the overall scores of the males and females for the *Date Fingers* ($p=0.002$), with the males showing a greater preference for this sweet than the females. There was also a significant difference between the overall scores of the westernised and black subgroups for the *Coconut Ice* ($p=0.005$), with the westernised subgroup showing a greater preference for the dish. All the desserts and sweets tested received an overall acceptability score above 6 for all subgroups combined.



* Significant difference ($p<0.05$)

Figure 3.5: Overall Scores – Desserts and sweets

Abbreviations: BA: Baked Apples in Custard Sauce; AP: Baked Apple Pudding; PP: Poached Pears; FS: Fruit Salad; MB: Marie Biscuit Fudge; FK: Fruit Kebabs; CI: Coconut Ice; FJ: Fruit Jelly; DF: Date Fingers

3.2.4 Appearance Scores for Main Meals

The mean appearance scores for the main meals are shown in Table 3.2. The lowest score per subgroup is indicated in light grey and dark grey indicates the highest score per subgroup. The appearance scores for all subgroups combined showed that the *Pineapple Chicken* scored the highest [8.00(1.17)] while both the *Risotto* and the *Fish and Vegetable Pie* scored the lowest [6.89(2.23) and 6.89(1.92)]. Females scored the *Chicken Pilaf* the highest for appearance [8.21(0.79)], while the males scored the *Bobotie* the highest [8.00(1.04)]. Males scored the *Fish and Vegetable Pie* the lowest [6.07(2.15)] while the females scored the *Risotto* the lowest [6.58(2.22)]. The black participants scored the *Indian Pork Dish* the highest for appearance [8.50(0.55)] while the westernised participants preferred the *Pineapple Chicken* [8.18(1.16)].

There was a significant difference between the appearance scores of the males and females for the *Chicken Pilaf* (p=0.008) and the *Fish and Vegetable Pie* (p=0.021) with the females showing a greater preference for this dish than the males. There were no significant differences between the appearance scores for the westernised and black subgroups.

Table 3.2: Mean appearance scores for main meals

Appearance	Risotto	Pineapple Chicken	Indian Pork Dish	Bobotie	Beef Kebabs	Vegetable Lasagna	Vegetable Paella	Fish and Vegetable Pie	Chicken Pilaf	Greenbean Stew
	Mean score (Standard deviation)									
Female	**6.58 (2.22)**	8.05 (1.10)	7.94 (1.16)	7.81 (1.25)	7.26 (1.86)	7.14 (1.93)	7.63 (1.30)	7.50[a] (1.50)	**8.21[a] (0.79)**	7.63 (1.34)
Male	7.25 (2.27)	7.94 (1.29)	7.71 (1.64)	**8.00 (1.04)**	7.40 (2.26)	6.63 (1.54)	6.93 (2.09)	**6.07[b] (2.15)**	7.19[b] (1.42)	6.94 (1.91)
Black	**4.60 (3.13)**	7.43 (1.13)	**8.50 (0.55)**	7.71 (1.38)	5.50 (3.11)	5.86 (2.55)	6.83 (1.60)	7.29 (1.80)	7.71 (0.95)	7.00 (1.91)
Coloured and White	7.27 (1.86)	**8.14 (1.16)**	7.69 (1.46)	7.93 (1.12)	7.57 (1.76)	7.17 (1.49)	7.43 (1.73)	**6.79 (1.97)**	7.75 (1.29)	7.39 (1.59)
Subgroups combined	**6.89 (2.23)**	**8.00 (1.17)**	7.84 (1.37)	7.89 (1.16)	7.32 (2.01)	6.92 (1.77)	7.32 (1.70)	**6.89 (1.92)**	7.74 (1.22)	7.31 (1.64)

[a,b] Significant differences (p<0.05)between subgroups indicated with different lettering

3.2.5 Appearance Scores for Side Dishes

The mean appearance scores for the side dishes are shown in Table 3.3. The lowest score per subgroup is indicated in light grey and dark grey indicates the highest score per subgroup. The appearance scores for all subgroups combined showed that the *Vegetarian Mushroom Dish* scored the highest [7.82(1.49)] and the *Rice Salad* second highest

[7.64(1.69)]. The *Greenbean, Pea and Mushroom salad* scored the lowest [4.80(2.62)], with all subgroups, except the black subgroup, giving the dish the lowest appearance score overall.

There was no significant difference between the male and female subgroups. However, there was a significant difference between the appearance scores of the westernised and black subgroups for the *Rice Salad* (p=0.004) and the *Wheat and Mushroom Casserole* (p=0.017) with the black subgroup showing a lower preference for these dishes than the westernised subgroup.

Table 3.3: Mean appearance scores for side dishes

Appearance	Pumpkin Fritters	Mushroom Salad	Rice Salad	Wheat and Mushroom Casserole	Cabbage Pot	Veg Mushroom Dish	Peas in Lemon and Mint Sauce	Potato Fritters	Brussels Sprouts	Curried Wheat Salad
	Mean score (Standard deviation)									
Female	7.39 (1.24)	**4.95 (2.30)**	**7.70 (1.84)**	4.78 (2.29)	6.62 (2.11)	7.63 (1.71)	6.86 (2.22)	7.00 (1.45)	6.20 (2.07)	6.74 (2.00)
Male	6.76 (2.14)	**4.63 (3.03)**	7.56 (1.55)	4.87 (1.92)	6.14 (1.92)	**8.07 (1.16)**	5.94 (2.11)	6.47 (1.81)	5.53 (2.33)	7.13 (2.06)
Black	6.50 (2.35)	4.40 (2.30)	5.57[a] (2.51)	**3.14[a] (1.35)**	6.71 (1.80)	**7.50 (2.38)**	6.00 (2.58)	5.67 (2.66)	5.29 (2.50)	5.57 (2.23)
Coloured and White	7.21 (1.61)	**4.87 (2.70)**	8.14[b] (0.95)	5.27[b] (2.05)	6.36 (2.09)	**7.87 (1.38)**	6.57 (2.13)	7.00 (1.25)	6.07 (2.11)	7.25 (1.84)
Subgroups combined	7.09 (1.74)	**4.80 (2.62)**	7.64 (1.69)	4.82 (2.10)	6.43 (2.02)	**7.82 (1.49)**	6.46 (2.19)	6.76 (1.62)	5.91 (2.17)	6.91 (2.01)

[a,b] Significant differences (p<0.05) between subgroups indicated with different lettering

3.2.6 Appearance Scores for Desserts and Sweets

The mean appearance scores for the desserts and sweets are shown in Table 3.4. The lowest score per subgroup is indicated in light grey and dark grey indicates the highest score per subgroup. The appearance score for all subgroups combined, as well as the male and black subgroups, showed that the *Marie Biscuit Fudge* scored the highest [8.43(1.07), 8.57(0.65) and 8.57(0.53) respectively]. The *Fruit Kebabs* scored second highest overall for appearance [8.30(1.10)] with the females preferring this dessert [8.67(0.49)]. All participant subgroups gave the *Poached Pears* the lowest score ranging from 6.21 to 6.45, except for the black participants who scored the *Baked Apples in Custard Sauce* and the *Coconut Ice* the lowest [6.29(2.75) and 6.29(2.81)].

There was a significant difference between the appearance scores of the males and females for the *Date Fingers* (p=0.008) with the males showing a greater preference for the sweet

than the females. There was also a significant difference between the male and female scores for the *Fruit Kebabs* (p=0.039) with the females showing a greater preference for the dessert than the males. There was a significant difference between the appearance scores of the westernised and black subgroups for the *Coconut Ice* (p=0.011) with the black subgroup showing a lower preference for the sweet than the westernised subgroup.

Table 3.4: Mean appearance scores for desserts and sweets

Appearance	Date Fingers	Fruit Jelly	Coconut Ice	Fruit Kebabs	Marie Biscuit Fudge	Fruit Salad	Pancakes	Poached Pears	Apple Pudding	Baked Apples
	Mean score (Standard deviation)									
Female	7.06[a] (2.04)	8.16 (1.34)	8.15 (1.69)	**8.67[a] (0.49)**	8.33 (1.28)	8.37 (0.96)	8.15 (1.14)	**6.45 (1.96)**	8.45 (1.19)	7.42 (1.64)
Male	8.29[b] (1.21)	8.06 (1.53)	8.13 (1.54)	7.87[b] (1.46)	**8.57 (0.65)**	7.73 (1.53)	7.79 (0.80)	**6.21 (2.04)**	8.07 (1.58)	7.31 (2.44)
Black	6.67 (2.35)	7.40 (2.51)	6.29[a] (2.81)	7.86 (1.77)	**8.57 (0.53)**	6.75 (2.22)	7.71 (1.11)	6.43 (1.51)	8.00 (1.83)	**6.29 (2.75)**
Coloured and White	7.86 (1.61)	8.23 (1.17)	**8.59[b] (0.68)**	8.42 (0.86)	8.39 (1.17)	8.27 (1.01)	8.07 (1.00)	**6.33 (2.09)**	8.36 (1.25)	7.64 (1.75)
Subgroups combined	7.66 (1.74)	8.11 (1.41)	8.14 (1.61)	8.30 (1.10)	**8.43 (1.07)**	8.09 (1.26)	8.00 (1.02)	**6.35 (1.97)**	8.29 (1.36)	7.37 (2.02)

[a,b] Significant differences (p<0.05) between subgroups indicated with different lettering

3.2.7 Smell Scores for Main Meals

The mean smell scores for the main meals are shown in Table 3.5. The lowest score per subgroup is indicated in light grey and dark grey indicates the highest score per subgroup. The smell scores, for all subgroups combined, showed that the *Bobotie* scored the highest [8.00(1.14)], closely followed by the *Pineapple Chicken*, *Indian Pork Dish* and *Chicken Pilaf* with scores above 7.50. The females scored the *Chicken Pilaf* the highest with a score of 8.16(0.76), while the males scored the *Indian Pork Dish* and the *Bobotie* the highest [8.00(0.88) and 8.00(1.04) respectively]. The black subgroup scored the *Indian Pork Dish* the highest for smell [8.50(0.55)] while the westernised subgroup preferred the *Pineapple Chicken* and *Bobotie* [8.00(1.36) and 8.00(1.09) respectively]. The black subgroup scored the *Risotto* the lowest [4.60(3.13)], while the westernised subgroup scored the *Fish and Vegetable Pie* the lowest [6.79(1.93)].

There was a significant difference between the smell scores of the males and females for the *Chicken Pilaf* (p=0.047) and *Fish and Vegetable Pie* (p=0.030) with the females showing a greater preference for these two dishes than the males. There were no significant differences between the westernised and black subgroups.

Table 3.5: Mean smell scores for main meals

Smell	Risotto	Pineapple Chicken	Indian Pork Dish	Bobotie	Beef Kebabs	Vegetable Lasagna	Vegetable Paella	Fish and Vegetable Pie	Chicken Pilaf	Greenbean Stew
	Mean score (Standard deviation)									
Female	**6.63 (2.27)**	7.85 (1.39)	7.67 (1.57)	8.00 (1.22)	7.42 (1.80)	7.10 (1.89)	7.53 (1.43)	7.45[a] (1.47)	**8.16[a] (0.76)**	7.63 (1.34)
Male	7.19 (2.23)	7.94 (1.29)	**8.00 (0.88)**	**8.00 (1.04)**	7.27 (2.19)	6.38 (1.71)	6.87 (2.07)	**6.1[b] (2.17)**	7.31[b] (1.49)	7.06 (1.91)
Black	**4.60 (3.13)**	7.43 (1.13)	**8.50 (0.55)**	8.00 (1.41)	5.75 (3.31)	5.86 (2.54)	6.83 (1.60)	7.29 (1.80)	7.71 (0.95)	7.00 (1.91)
Coloured and White	7.27 (1.86)	**8.00 (1.36)**	7.65 (1.38)	**8.00 (1.09)**	7.57 (1.68)	7.00 (1.60)	7.32 (1.79)	**6.79 (1.93)**	7.79 (1.29)	7.46 (1.57)
Subgroups combined	6.89 (2.23)	7.89 (1.33)	7.81 (1.31)	**8.00 (1.14)**	7.35 (1.95)	**6.78 (1.83)**	7.24 (1.74)	6.89 (1.89)	7.77 (1.21)	7.37 (1.63)

[a,b] Significant differences ($p<0.05$) between subgroups indicated with different lettering

3.2.8 Smell Scores for Side Dishes

The mean smell scores for the side dishes are shown in Table 3.6. The lowest score per subgroup is indicated in light grey and dark grey indicates the highest score per subgroup. The smell scores, for all subgroups combined, showed that the *Vegetarian Mushroom Dish* scored the highest [7.82(1.49)], while the *Greenbean, Pea and Mushroom Salad* scored the lowest [4.60(1.65)]. Almost all the subgroups, except for the westernised subgroup, scored the *Vegetarian Mushroom Dish* the highest with scores ranging from 7.50 and 8.07. The westernised participants preferred the *Rice Salad* [8.03(0.91)]. The lowest smell scores for all subgroups were either given to the *Greenbean, Pea and Mushroom Salad* [male subgroup 4.25(1.50), westernised subgroup 4.63(0.91)] or the *Wheat and Mushroom Casserole* [female subgroup 4.72(2.19) and black subgroup 3.14(1.35)].

There were no significant differences between the smell scores of the male and female subgroups, although there was a significant difference between these scores in the westernised and black subgroups for the *Rice Salad* ($p=0.007$) and the *Wheat and Mushroom Casserole* ($p=0.013$), with the westernised subgroup having a greater preferences for these two dishes.

Table 3.6: Mean smell scores for side dishes

Smell	Pumpkin Fritters	Mushroom Salad	Rice Salad	Wheat and Mushroom Casserole	Cabbage Pot	Veg Mushroom Dish	Peas in Lemon and Mint Sauce	Potato Fritters	Brussels Sprouts	Curried Wheat Salad
	Mean Score (Standard deviation)									
Female	7.17 (1.34)	4.89 (1.79)	7.55 (1.79)	**4.72 (2.19)**	6.62 (2.11)	**7.63 (1.71)**	6.95 (2.13)	6.95 (1.47)	6.25 (2.02)	6.84 (2.01)
Male	7.00 (2.06)	**4.25 (1.50)**	7.56 (1.50)	4.87 1.77)	6.07 (1.98)	**8.07 (1.16)**	5.63 (2.28)	6.20 (1.93)	5.53 (2.26)	7.19 (2.01)
Black	7.33 (1.63)	4.40 (2.51)	5.57[a] (2.51)	**3.14[a] (1.35)**	6.71 (1.80)	**7.50 (2.38)**	6.00 (2.58)	5.67 (2.66)	5.29 (2.50)	5.71 (2.29)
Coloured and White	7.03 (1.74)	**4.63 (0.91)**	**8.03[b] (0.91)**	5.23[b] (1.90)	6.32 (2.13)	7.87 (1.38)	6.47 (2.22)	6.82 (1.42)	6.11 (2.04)	7.32 (1.81)
Subgroups combined	7.09 (1.70)	**4.60 (1.65)**	7.56 (1.65)	4.79 (1.98)	6.40 (2.05)	**7.82 (1.49)**	6.38 (2.27)	6.62 (1.71)	5.94 (2.13)	7.00 (1.99)

[a,b] Significant differences ($p<0.05$) between subgroups indicated with different lettering

3.2.9 Smell Scores for Desserts and Sweets

The mean smell scores for the desserts and sweets are shown in Table 3.7. The lowest score per subgroup is indicated in light grey and dark grey indicates the highest score per subgroup. The smell scores for all subgroups combined, as well as the male and black subgroups, showed that the *Marie Biscuit Fudge* scored the highest for smell [8.40(1.06), 8.50(0.65) and 8.57(0.53) respectively]. The *Fruit Kebabs* scored the highest with the females [8.61(0.50)]. The westernised subgroup scored the *Coconut Ice* the highest for smell [8.48(0.95)]. All participant subgroups scored the *Poached Pears* the lowest with scores ranging from 6.14 to 6.48.

There was a significant difference between the smell scores of the males and females for the *Date Fingers* ($p=0.001$), with the males showing a greater preference for the sweet than the females. There was also a significant difference between the smell scores of the westernised and black subgroups for the *Coconut Ice* ($p=0.015$) with the black subgroup showing a lower preference for this dish than the westernised subgroup.

Table 3.7: Mean smell scores for desserts and sweets

Smell	Date Fingers	Fruit Jelly	Coconut Ice	Fruit Kebabs	Marie Biscuit Fudge	Fruit Salad	Pancakes	Poached Pears	Apple Pudding	Baked Apples
	Mean Score (Standard deviation)									
Female	6.67[a] (2.22)	8.16 (1.34)	7.95 (1.82)	**8.61 (0.50)**	8.33 (1.28)	8.32 (0.95)	8.10 (1.12)	**6.40 (2.01)**	8.45 (1.19)	7.42 (1.64)
Male	8.35[b] (1.27)	7.94 (1.53)	8.19 (1.56)	7.67 (1.68)	**8.50 (0.65)**	7.47 (1.51)	7.79 (0.80)	**6.43 (1.79)**	8.07 (1.53)	7.44 (2.37)
Black	6.67 (2.07)	7.40 (2.51)	6.29[a] (2.81)	7.86 (1.77)	**8.57 (0.53)**	6.75 (2.22)	7.71 (1.11)	**6.14 (1.77)**	8.00 (1.83)	6.29 (2.75)
Coloured and White	7.66 (1.97)	8.17 (1.18)	**8.48[b] (0.95)**	8.27 (1.16)	8.36 (1.16)	8.10 (1.06)	8.04 (0.98)	**6.48 (1.95)**	8.36 (1.22)	7.71 (1.67)
Subgroups combined	7.49 (1.99)	8.06 (1.41)	8.06 (1.69)	8.18 (1.26)	**8.40 (1.06)**	7.94 (1.28)	7.97 (1.00)	**6.41 (1.89)**	8.29 (1.34)	7.43 (1.97)

[a,b] Significant differences ($p<0.05$) between subgroups indicated with different lettering

3.2.10 Texture Scores for Main Meals

The mean texture scores for the main meals are shown in Table 3.8. The lowest score per subgroup is indicated in light grey and dark grey indicates the highest score per subgroup. The texture scores for all subgroups combined showed that the *Bobotie* and the *Pineapple Chicken* scored the highest [8.00(1.11) and 8.00(1.15) respectively], followed closely by the *Indian Pork Dish* [7.91(1.17)]. The females scored the *Chicken Pilaf* the highest for texture [8.16(0.76)], while the males scored the *Indian Pork Dish* the highest [8.14(0.95)]. The black subgroup scored the *Indian Pork Dish* the highest for texture [8.50(0.55)] while the westernised subgroup preferred the *Pineapple Chicken* [8.14(1.13)]. The black and female subgroups scored the *Risotto* the lowest [4.60(3.13) and 6.58(2.22) respectively], while the westernised and male subgroups scored the *Fish and Vegetable Pie* the lowest [6.71(2.03) and 6.00(2.30) respectively].

There was a significant difference between the texture scores of the males and females for the *Chicken Pilaf* ($p=0.012$) and *Fish and Vegetable Pie* ($p=0.037$) with the females showing a greater preference for these two dishes than the males. There were no significant differences between the westernised and black subgroups.

Table 3.8: Mean texture scores for main meals

Texture	Risotto	Pineapple Chicken	Indian Pork Dish	Bobotie	Beef Kebabs	Vegetable Lasagna	Vegetable Paella	Fish and Vegetable Pie	Chicken Pilaf	Greenbean Stew
	Mean Score (Standard deviation)									
Female	**6.58 (2.22)**	8.10 (1.12)	7.72 (1.32)	8.05 1.20)	7.42 (1.80)	7.14 (1.93)	7.53 (1.43)	7.45[a] (1.47)	**8.16[a] (0.76)**	7.63 (1.34)
Male	6.94 (2.35)	7.88 (1.20)	**8.14 (0.95)**	7.93 (1.00)	7.27 (2.19)	6.69 (1.70)	6.87 (2.23)	**6.00[b] (2.30)**	7.19[b] (1.42)	7.06 (1.91)
Black	**4.60 (3.13)**	7.43 (1.13)	**8.50 (0.55)**	8.00 (1.41)	5.75 (3.30)	5.86 (2.54)	7.00 (1.67)	7.29 (1.80)	7.71 (0.95)	7.00 (1.91)
Coloured and White	7.10 (1.92)	**8.14 (1.13)**	7.77 (1.24)	8.00 (1.05)	7.57 (1.68)	7.20 (1.56)	7.29 (1.88)	**6.71 (2.03)**	7.71 (1.27)	7.46 (1.57)
Subgroups combined	**6.74 (2.25)**	**8.00 (1.15)**	7.91 (1.17)	**8.00 (1.11)**	7.35 (1.95)	6.95 (1.82)	7.24 (1.83)	6.83 (1.98)	7.71 (1.20)	7.37 (1.63)

[a,b] Significant differences ($p<0.05$) between subgroups indicated with different lettering

3.2.11 Texture Scores for Side Dishes

The mean texture scores for the side dishes are shown in Table 3.9. The lowest score per subgroup is indicated in light grey and dark grey indicates the highest score per subgroup. The texture scores for all subgroups combined showed that the *Vegetarian Mushroom Dish* scored the highest [7.79(1.47)], with both the male and black subgroups giving it the highest score [8.00(1.13) and 7.5(2.38) respectively]. The *Greenbean, Pea and Mushroom Salad* and *Wheat and Mushroom Casserole* scored the lowest, with scores ranging from 3.81 to 4.95 for the *Greenbean, Pea and Mushroom Salad* and 3.14 to 5.12 for the *Wheat and Mushroom Casserole* for all subgroups and all subgroups combined.

There were no significant differences between the texture scores for the male and female subgroups. There was a significant difference between the texture scores of the westernised and black subgroups for the *Rice Salad* ($p=0.005$) and the *Wheat and Mushroom Casserole* ($p=0.025$) with the westernised subgroup having a greater preferences for these two dishes.

Table 3.9: Mean texture scores for side dishes

Texture	Pumpkin Fritters	Mushroom Salad	Rice Salad	Wheat and Mushroom Casserole	Cabbage Pot	Veg Mushroom Dish	Peas in Lemon and Mint sauce	Potato Fritters	Brussels Sprouts	Curried Wheat Salad
	Mean Score (Standard deviation)									
Female	7.28 (1.49)	4.95 (2.30)	**7.65 (1.81)**	**4.56 (2.28)**	6.67 (2.11)	7.63 (1.71)	6.52 (2.29)	6.89 (1.41)	6.30 (2.00)	6.89 (2.02)
Male	7.35 (1.87)	**3.81 (2.56)**	7.56 (1.55)	4.87 (1.85)	5.93 (2.06)	**8.00 (1.13)**	5.69 (2.15)	5.93 (2.28)	5.40 (2.29)	7.13 (2.06)
Black	7.00 (2.19)	4.40 (2.30)	5.57[a] (2.51)	**3.14[a] (1.35)**	6.71 (1.80)	**7.50 (2.38)**	6.00 (2.58)	5.67 (2.66)	5.29 (2.50)	5.86 (2.41)
Coloured and White	7.38 (1.57)	**4.43 (2.51)**	**8.10[b] (0.94)**	5.12[b] (2.05)	6.29 (2.17)	7.83 (1.37)	6.20 (2.20)	6.64 (1.68)	6.07 (2.07)	7.29 (1.84)
Subgroups combined	7.31 (1.66)	**4.43 (2.45)**	7.61 (1.68)	4.70 (2.07)	6.37 (2.09)	**7.79 (1.47)**	6.16 (2.24)	6.47 (1.88)	5.91 (2.15)	7.00 (2.01)

[a,b] Significant differences ($p<0.05$) between subgroups indicated with different lettering

3.2.12 Texture Scores for Desserts and Sweets

The mean texture scores for the desserts and sweets are shown in Table 3.10. The lowest score per subgroup is indicated in light grey and dark grey indicates the highest score per subgroup. The texture scores for all subgroups combined, as well as the male and black subgroups, showed that the *Marie Biscuit Fudge* scored the highest [8.40(1.09), 8.57(0.65) and 8.57(0.53) respectively]. The *Fruit Kebabs* scored the highest with females who gave it a mean score of 8.61(0.50). The westernised participants scored the *Coconut Ice* the highest for texture [8.66(0.67)]. All participant subgroups gave the *Poached Pears* the lowest scores with scores ranging from 5.71 to 6.58.

There was a significant difference between the texture scores of the males and females for the *Date Fingers* ($p=0.001$) with the males showing a greater preference for the sweet than the females. There was also a significant difference between the texture scores of the westernised and black subgroups for the *Coconut Ice* ($p=0.005$) with the black subgroup showing a lower preference for this sweet than the westernised subgroup.

Table 3.10: Mean texture scores for desserts and sweets

Texture	Date Fingers	Fruit Jelly	Coconut Ice	Fruit Kebabs	Marie Biscuit Fudge	Fruit Salad	Pancakes	Poached Pears	Apple Pudding	Baked Apples
	Mean score (Standard deviation)									
Female	6.56[a] (2.09)	8.16 (1.34)	8.20 (1.70)	**8.61 (0.50)**	8.29 (1.31)	8.26 (0.99)	8.10 (1.12)	**6.25 (2.10)**	8.45 (1.19)	7.53 (1.47)
Male	8.24[b] (1.35)	8.06 (1.53)	8.19 (1.56)	7.80 (1.47)	**8.57 (0.65)**	7.67 (1.50)	7.93 (0.62)	**6.29 (2.05)**	8.13 (1.55)	7.31 (2.36)
Black	6.67 (2.16)	7.40 (2.51)	6.29[a] (2.81)	7.86 (1.77)	**8.57 (0.53)**	6.75 (2.22)	7.71 (1.11)	**5.71 (1.60)**	8.00 (1.83)	6.29 (2.75)
Coloured and White	7.52 (1.90)	8.23 (1.17)	**8.66[b] (0.67)**	8.35 (0.89)	8.36 (1.19)	8.17 (1.02)	8.11 (0.89)	**6.41 (2.15)**	8.39 (1.23)	7.71 (1.56)
Subgroups combined	7.37 (1.94)	8.11 (1.41)	8.19 (1.62)	8.24 (1.12)	**8.40 (1.09)**	8.00 (1.26)	8.03 (0.94)	**6.26 (2.05)**	8.31 (1.35)	7.43 (1.90)

[a,b] Significant differences ($p<0.05$) between subgroups indicated with different lettering

3.2.13 Taste Scores for Main Meals

The mean taste scores for the main meals are shown in Table 3.11. The lowest score per subgroup is indicated in light grey and dark grey indicates the highest score per subgroup. The taste scores for all subgroups combined showed that the *Bobotie* and the *Pineapple Chicken* scored the highest [7.97(1.12) and 7.97(1.30)], followed closely by the *Indian Pork Dish* [7.91(1.23)]. The *Risotto* received the lowest score for all participants [6.77(2.28)] followed closely by the *Vegetable Lasagna* [6.78(1.89)]. The females scored the *Chicken Pilaf* the highest [8.21(0.79)], while the males scored the *Indian Pork Dish* the highest [8.07(1.00)]. The black subgroup scored the *Indian Pork Dish* the highest for taste [8.33(0.82)] while the westernised subgroup preferred the *Pineapple Chicken* [8.10(1.32)]. The black and female subgroups scored the *Risotto* the lowest [4.60(3.13) and 6.63(2.27) respectively], while the westernised and male subgroups scored the *Fish and Vegetable Pie* the lowest [6.71(2.03) and 6.00(2.30) respectively].

There was a significant difference between the taste scores of the males and females for the *Chicken Pilaf* ($p=0.008$) and *Fish and Vegetable Pie* ($p=0.037$) with the females showing a greater preference for these two dishes than the males. There were no significant differences in the taste scores of the westernised and black subgroups.

Table 3.11: Mean taste scores for main meals

Taste	Risotto	Pineapple Chicken	Indian Pork Dish	Bobotie	Beef Kebabs	Vegetable Lasagna	Vegetable Paella	Fish and Vegetable Pie	Chicken Pilaf	Greenbean Stew
	Mean score (Standard deviation)									
Female	**6.63 (2.27)**	8.00 (1.28)	7.78 (1.40)	8.05 (1.20)	7.42 (1.84)	7.14 (1.93)	7.47 (1.54)	7.45[a] (1.47)	**8.21[a] (0.79)**	7.63 (1.34)
Male	6.94 (2.35)	7.94 (1.24)	**8.07 (1.00)**	7.86 (1.03)	7.20 (2.24)	6.31 (1.78)	6.80 (2.21)	**6.00[b] (2.30)**	7.19[b] (1.42)	7.06 (1.91)
Black	**4.60 (3.13)**	7.43 (1.13)	**8.33 (0.82)**	8.00 (1.41)	5.50 (3.11)	5.86 (2.54)	7.00 (1.67)	7.29 (1.80)	7.71 (0.95)	7.00 (1.91)
Coloured and White	7.13 (1.94)	**8.10 (1.32)**	7.81 (1.30)	7.96 (1.07)	7.57 (1.74)	7.00 (1.68)	7.21 (1.93)	**6.71 (2.03)**	7.75 (1.30)	7.46 (1.57)
Subgroups combined	**6.77 (2.28)**	**7.97 (1.30)**	7.91 (1.23)	**7.97 (1.12)**	7.32 (2.00)	6.78 (1.89)	7.18 (1.87)	6.83 (1.98)	7.74 (1.22)	7.37 (1.63)

[a,b] Significant differences ($p<0.05$) between subgroups indicated with different lettering

3.2.14 Taste Scores for Side Dishes

The mean taste scores for the side dishes are shown in Table 3.12. The lowest score per subgroup is indicated in light grey and dark grey indicates the highest score per subgroup. The taste scores for all subgroups combined showed that the *Vegetarian Mushroom Dish* scored the highest [7.82(1.49)], followed by the *Rice Salad* [7.50(1.76)]. The male, female and black subgroups gave the highest score to the *Vegetarian Mushroom Dish* [8.07(1.16), 7.63(1.70) and 7.50(2.38) respectively]. The *Greenbean, Pea and Mushroom Salad* had the lowest combined taste score [4.46(2.55)], while the *Wheat and Mushroom Casserole* followed closely with a score of 4.7(2.10).

There were no significant differences between the taste scores for the male and female subgroups. There was a significant difference between the taste scores of the westernised and black subgroups for the *Rice Salad* ($p=0.008$) and the *Wheat and Mushroom Casserole* ($p=0.025$) with the westernised subgroup having a greater preferences for these two dishes.

Table 3.12: Mean taste scores for side dishes

Taste	Pumpkin Fritters	Mushroom Salad	Rice Salad	Wheat and Mushroom Salad	Cabbage Pot	Veg Mushroom Dish	Peas in Lemon and Mint Sauce	Potato Fritters	Brussels Sprouts	Curried Wheat Salad
	Mean score (Standard deviation)									
Female	7.39 (1.42)	4.84 (2.39)	7.40 (1.96)	**4.61 (2.38)**	6.52 (2.32)	**7.63 (1.70)**	6.33 (2.54)	6.84 (1.46)	6.30 (2.00)	6.79 (2.07)
Male	7.24 (1.82)	**4.00 (2.73)**	7.63 (1.54)	4.80 (1.78)	6.07 (1.98)	**8.07 (1.16)**	5.94 (2.29)	6.07 (2.22)	5.07 (2.28)	7.13 (2.06)
Black	7.00 (2.19)	4.40 (2.30)	5.57[a] (2.51)	**3.14[a] (1.35)**	6.71 (1.80)	**7.50 (2.38)**	5.00 (3.00)	5.67 (2.66)	5.29 (2.50)	5.57 (2.23)
Coloured and White	7.38 (1.50)	**4.47 (2.62)**	**7.97[b] (1.18)**	5.12[b] (2.08)	6.25 (2.27)	7.87 (1.38)	6.43 (2.22)	6.68 (1.63)	5.89 (2.13)	7.29 (1.84)
Subgroups combined	7.31 (1.60)	**4.46 (2.55)**	7.50 (1.76)	4.70 (2.10)	6.34 (2.17)	**7.82 (1.49)**	6.16 (2.41)	6.50 (1.85)	5.77 (2.18)	6.94 (2.01)

[a,b] Significant differences ($p<0.05$) between subgroups indicated with different lettering

3.2.15 Taste Scores for Desserts and Sweets

The mean taste scores for the desserts and sweets are shown in Table 3.13. The lowest score per subgroup is indicated in light grey and dark grey indicates the highest score per subgroup. The taste scores for all subgroups combined, as well as the male and black subgroups, showed that the *Marie Biscuit Fudge* scored the highest [8.43(1.07), 8.57(0.65) and 8.57(0.53) respectively]. The *Fruit Kebabs* scored the highest with the females [8.67(0.49)], while the westernised subgroup gave the highest taste score to the *Coconut Ice* [8.62(0.78)]. All participant subgroups gave the *Poached Pears* the lowest score with scores ranging from 5.29 to 6.41.

There was a significant difference between the taste scores of the males and females for the *Date Fingers* ($p=0.005$) with the males showing a greater preference for the sweet than the females. There was also a significant difference between the taste scores of the westernised and black subgroups for the *Coconut Ice* ($p=0.006$) with the black subgroup showing a lower preference for this sweet than the westernised subgroup.

Table 3.13: Mean taste scores for desserts and sweets

Taste	Date Fingers	Fruit Jelly	Coconut Ice	Fruit Kebabs	Marie Biscuit Fudge	Fruit Salad	Pancakes	Poached Pears	Apple Pudding	Baked Apples
	Mean score (Standard deviation)									
Female	6.44[a] (2.04)	8.16 (1.34)	8.15 (1.76)	**8.67 (0.49)**	8.33 (1.29)	8.26 (1.00)	8.20 (0.89)	**6.10 (2.29)**	8.45 (1.19)	7.53 (1.47)
Male	8.29[b] (1.21)	7.88 (1.59)	8.19 (1.56)	7.93 (1.49)	**8.57 (0.65)**	7.53 (1.46)	7.93 (0.62)	**6.29 (2.05)**	8.13 (1.55)	7.31 (2.44)
Black	6.67 (2.16)	7.40 (2.51)	6.29[a] (2.81)	7.86 (1.77)	**8.57 (0.53)**	6.75 (2.22)	7.71 (1.11)	**5.29 (2.14)**	8.00 (1.83)	6.29 (2.75)
Coloured and White	7.48 (1.86)	8.13 (1.22)	**8.62[b] (0.78)**	8.46 (0.86)	8.39 (1.17)	8.10 (1.03)	8.19 (0.68)	**6.41 (2.15)**	8.39 (1.23)	7.71 (1.63)
Subgroups Combined	7.34 (1.91)	8.03 (1.44)	8.17 (1.65)	8.33 (1.11)	**8.43 (1.07)**	7.94 (1.25)	8.09 (0.79)	**6.18 (2.17)**	8.31 (1.35)	7.43 (1.94)

[a,b] Significant differences ($p<0.05$) between subgroups indicated with different lettering

3.3 PROPOSED RECIPES TO BE INCLUDED IN THE RENAL SMART SOFTWARE PROGRAMME

Recipes that received a score of 6 (Like slightly) or more for all the characteristics (overall score) by 80% of the study participants were deemed acceptable and are proposed for inclusion in the Renal Smart Software Programme. These values were chosen arbitrarily. A summary of the dishes deemed acceptable and unacceptable due to the scores given by the westernised participants are given in Table 3.14, while a summary of the dishes deemed acceptable and unacceptable by both the westernised and black subgroups are given in Table 3.15.

The *Greenbean, Pea and Mushroom Salad*, *Wheat and Mushroom Casserole*, *Cabbage Pot*, *Peas in Lemon and Mint Sauce*, *Potato Fritters*, *Brussels Sprouts with Tomato and Onion Sauce* as well as the *Poached Pears* were deemed unacceptable by the westernised subgroup and the westernised and black subgroups combined. It is therefore proposed that these dishes be excluded.

The nutritional analysis and allocated renal exchanges of recipes is shown in Appendix 6.6. The 30 final, formatted recipes with the nutritional analysis and renal exchanges are shown in Appendix 6.7. These include the 23 recipes proposed to be included in the Renal Smart Software Programme as well as the 7 recipes that were deemed unacceptable.

Table 3.14: Acceptability of dishes – Westernised participants

Dish:	Total number of participants who evaluated the dish:	Number and percentage of participants with a score of 6 and above:		Number and percentage of participants with a score of 5 and below:		Dish acceptable or unacceptable:
MAIN MEALS:		**n**	**%**	**n**	**%**	
Greenbean Stew	28	26	92.86	2	7.14	√
Risotto	30	25	83.33	5	16.67	√
Pineapple Chicken	29	29	100.00	0	0	√
Indian Pork Dish	26	26	100.00	0	0	√
Bobotie	28	27	96.48	1	3.52	√
Beef Kebabs	30	27	90.00	3	10.00	√
Vegetable Lasagna	30	26	86.67	4	13.33	√
Vegetable Paella	28	23	82.14	5	17.86	√
Fish and Vegetable Pie	28	23	82.14	5	17.86	√
Chicken Pilaf	28	26	92.86	2	7.14	√
SIDE DISHES:						
Pumpkin Fritters	29	25	86.21	4	13.79	√
Greenbean, Pea and Mushroom Salad	30	10	33.33	20	66.67	x
Rice Salad	29	29	100.00	0	0	√
Wheat and Mushroom Casserole	26	10	38.46	16	61.54	x
Cabbage Pot	28	21	75.00	7	25.00	x
Vegetarian Mushroom Dish	30	28	93.33	2	6.67	√
Peas in Lemon and Mint Sauce	30	21	70.00	9	30.00	x
Potato Fritters	28	22	78.57	6	21.43	x
Brussels sprouts with Tomato and Onion Sauce	28	18	64.29	10	35.71	x
Curried Wheat Salad	28	24	92.86	4	7.14	√
DESSERTS AND SWEETS:						
Date Fingers	29	27	93.10	2	6.9	√
Fruit Jelly	30	29	96.67	1	3.33	√
Coconut Ice	29	29	100.00	0	0	√
Fruit Kebabs	26	25	96.15	1	3.85	√
Marie Biscuit Fudge	28	27	96.43	1	3.57	√
Fruit Salad	30	29	96.67	1	3.33	√
Cinnamon Sugar Pancakes	28	28	100.00	0	0	√
Poached Pears	28	21	75.00	7	25.00	x
Baked Apple Pudding	28	27	96.43	1	3.57	√
Baked Apples in Custard Sauce	28	26	92.86	2	7.14	√

Table 3.15: Acceptability of dishes – Westernised and Black participants

Dish:	Total number of participants who evaluated the dish:	Number and percentage of participants with a score of 6 and above:		Number and percentage of participants with a score of 5 and below:		Dish acceptable or unacceptable:
MAIN MEALS:		**n**	**%**	**n**	**%**	
Greenbean Stew	35	32	91.43	3	8.57	√
Risotto	35	27	77.14	8	22.86	x
Pineapple Chicken	36	36	100	0	0	√
Indian Pork Dish	32	32	100	0	0	√
Bobotie	35	33	94.29	2	5.71	√
Beef Kebabs	34	29	85.29	5	14.71	√
Vegetable Lasagna	37	30	81.08	7	18.92	√
Vegetable Paella	34	28	82.35	6	17.65	√
Fish and Vegetable Pie	35	29	82.86	6	17.14	√
Chicken Pilaf	35	33	94.29	2	5.71	√
SIDE DISHES:						
Pumpkin Fritters	35	30	85.71	5	14.29	√
Greenbean, Pea and Mushroom Salad	35	11	31.43	24	68.57	x
Rice Salad	36	33	91.37	3	8.33	√
Wheat and Mushroom Casserole	33	10	30.30	23	69.70	x
Cabbage Pot	35	27	77.14	8	22.86	x
Vegetarian Mushroom Dish	34	31	91.18	3	8.82	√
Peas in Lemon and Mint Sauce	37	27	72.97	10	27.03	x
Potato Fritters	34	25	73.53	9	26.47	x
Brussels sprouts with Tomato and Onion Sauce	35	22	62.86	13	37.14	x
Curried Wheat Salad	35	28	80.00	7	20.00	√
DESSERTS AND SWEETS:						
Date Fingers	35	31	88.57	4	11.43	√
Fruit Jelly	35	33	94.29	2	5.71	√
Coconut Ice	36	34	94.44	2	5.56	√
Fruit Kebabs	33	31	93.94	2	6.06	√
Marie Biscuit Fudge	35	34	97.14	1	2.86	√
Fruit Salad	34	32	94.12	2	5.88	√
Cinnamon Sugar Pancakes	34	34	100.00	0	0	√
Poached Pears	34	23	67.65	11	32.35	x
Baked Apple Pudding	35	33	94.29	2	5.71	√
Baked Apples in Custard Sauce	35	31	88.57	4	11.43	√

CHAPTER 4: DISCUSSION

4.1 INTRODUCTION

Thirty recipes were identified for adaptation and sensory evaluation by the study population. A variety of westernised recipes were included to suit the different tastes of individuals living in the Western Cape. Recipes were tested and adapted to suit the needs of the patient with CRF and then nutritionally analysed. Of the 30 recipes that were evaluated for overall acceptance, appearance, smell, texture and taste, only 7 were excluded. Recipes were excluded when less than 80% of the study participants gave a mean overall score of more than 6. Five recipes received a score of 6 or more by all participants in the westernised study population.

Significant differences were found between the male and female subgroups, for only a few recipes tested, including the *Fish and Vegetable Pie*, *Chicken Pilaf* and *Date Fingers*. The females showed a greater preference for these two main meals while the males showed a greater preference for the dessert.

In all instances where significant differences were found between the black and westernised subgroups, the westernised subgroup showed a greater preference for the dishes than the black subgroup. Significant differences were found for the *Rice Salad*, *Wheat and Mushroom Casserole*, *Curried Wheat Salad* and the *Coconut Ice*.

4.2 MAIN OBJECTIVES

People spend an enormous amount of time planning, organising and preparing the food that the body will use for nourishment and fuel. However, several different factors influence our food preferences. These factors are a combination of life influences such as geography, lifestyle, physiology, psychology, culture and socialisation.[81] With all these different influences, choosing recipes suitable for a specific population can become challenging. Therefore, for the purpose of this study the researcher focused specifically on choosing recipes suitable for those following a westernised diet. However, even within this specific population group, several other factors also contribute to food preference, such as socio-economic factors and social status, group identity and health, to name only a few. The researcher therefore incorporated a variety of recipes to suit the different needs of this specific population. These included cheaper and more expensive recipes, healthier and “less healthy” options such as recipes containing higher amounts of fat and sugar, and different types of dishes, including vegetarian options, beef, chicken, fish and pork options, vegetable dishes, starch-based dishes as well as desserts and sweets containing mostly fruit or with a high sugar content. It is important however to state that these recipes were selected and tested within the South African context and it should not be assumed that they would

therefore be acceptable within all populations following a westernised diet. Geography and variations in climate influence the type of food that can be and usually is cultivated in a specific area. These factors also have a profound influence on the availability of particular foods and in turn, on the eating patterns of people living in the area[6] – in this case the Western Cape.

Choosing recipes specifically suited for patients with CRF was an added challenge, not only because of the dietary restrictions these patients face, but also due to the possible taste abnormalities they may have. Taste abnormalities in patients on dialysis have been well-documented,[50,51,53-57] although the findings have been controversial and sometimes conflicting. Some studies have shown that sweet and sour taste may be affected,[54,55] another study indicated that salty tastes are affected,[56] while it has also been documented that total taste acuity can be affected.[57] Thus, including or excluding certain dishes on the basis of possible taste abnormalities that may occur, could not be done.

As a result of the generally low nutrient intake of patients with CRF due to various factors including anorexia caused by uremic toxicity, impaired gastric emptying, inflammation and depression,[15,45,47] it was important to try and include exciting, tasty recipes that the patients would find attractive and easy to incorporate into their daily lifestyle. Since these patients are already restricted by what they may or may not eat; it was also taken into account that the recipes included should be ones that healthy individuals would also find acceptable, so that they can be prepared for the whole family, encouraging the patient to feel part of the normal menu planning and decision-making within the household.

Recipes popular within the healthy westernised population, as well as older recipes[75-77] previously prescribed by dietitians for renal patients, were prepared according to the original quantities and then evaluated by the researcher and research assistant for overall acceptance, appearance, smell, texture and taste. Recipes were then nutritionally analysed using the Foodfinder 3 computer software program and then adapted to suit the dietary needs of renal patients. These adaptations included decreasing the portion size, removing or reducing table salt from the recipe, decreasing or omitting protein-rich, sodium-rich, potassium-rich and/or phosphate-rich ingredients within the recipe. Some of these adaptations could affect the overall acceptability of the recipes and therefore sensory evaluation of the recipes, by the intended target group, was required.

4.3 SECONDARY OBJECTIVES

Although food choice is a complex process, some demographic variables such as gender, age, race and education may have an influence on food choice and preference behaviour.[82] The sample from the study population consisted of an almost equal number of males (n=22) and females (n=23), with almost three-quarters (n=33) of them being between the ages of 30 and 50 years. This may be due to the strict selection criteria followed by TAH and the limited number of patients selected for dialysis. The elderly are therefore often excluded due to the strict selection criteria.

Thirty-six of the 45 participants were coloured and there were only 7 black and 2 white patients participating in the study. This may be due to the location of TAH, situated in close proximity to the Cape Flats, inhabited mostly by coloured people with a few white and black people. Although the socio-economic status of the participants was not determined, it is assumed that the majority of patients are of a lower socio-economic status. The assumption is based on the fact that TAH is a government hospital and patients with a higher income and medical aid normally visit private hospitals and centres for dialysis.

Mean overall scores: For all subgroups combined it was interesting to note that the chicken and pork dishes scored the highest overall in the main meals category. This may be attributed to the fact that chicken is a popular dish for all races within the Western Cape and almost everyone is familiar with this meat. All the main meals received relatively high scores with a mean overall score for all recipes above 6. These scores suggest that the initial recipes that were chosen do indeed include popular and traditional dishes familiar within the context of the westernised diet.

The side dishes received lower scores for all subgroups combined, with recipes such as the *Greenbean, Pea and Mushroom Salad*, *Wheat and Mushroom Casserole* and the *Brussels Sprouts with Tomato and Onion Sauce* scoring below 6. The recipes that scored the highest were those to which cheese was added to the recipe or those that contained added fat, as in the case of the *Pumpkin Fritters*. It is of interest to note that in most cases the recipes with the higher fat and kilojoule content scored higher (*Pumpkin Fritters* and the *Vegetarian Mushroom Dish*) than the healthier options with lower fat and kilojoule content. A study by Nu *et al*. investigated the effects of age and gender on the food habits and preferences of adolescents in France. In this study, the researchers found that all adolescents, male and female, of all ages, disliked vegetables and preferred food with a higher fat and sugar content. Even though the study was performed on adolescents, it has been shown that food preferences are already formed during childhood and stay more or less the same during

adulthood. Although girls and women are more aware of body image and health issues than boys and men are, they still prefer foods with a higher sugar and fat content.[83,84] However, they will sometimes restrict these and increase the intake of foods that are perceived to be healthy, for the above-mentioned reasons.[83,84]

The desserts and sweets received high overall scores for all of the subgroups combined, with 6 recipes receiving a mean overall score of above 8. This may be due to the above-mentioned likes and dislikes of individuals – who normally have a higher preference for foods with a high sugar and fat content.[83] The *Poached Pears* received the lowest overall score, although the mean overall score was still above 6.

Mean appearance, smell, texture and taste scores: When comparing the mean scores for appearance, smell, texture and taste with the overall acceptance scores of the subgroups combined, it was clear that the participants gave very similar scores for each characteristic/sensory attribute when evaluating a specific recipe. This may be due to the Halo effect or the fact that most sensory attributes of food overlap and an untrained individual may perceive a mix of sensory impressions, making it very difficult to provide an independent evaluation of each attribute.[62] Therefore, if an individual gave a score of, for example 7, for appearance, it was very likely that the same individual gave a score of 7 for the other four attributes evaluated.

Scores for males and females:

The nutritional requirements and food habits of men and women differ in the adult years[85] and men and women face different nutrition- and diet-related problems.[84] While men tend to eat bigger portion sizes and prefer protein rich foods, women tend to be more concerned with their weight and more likely to eat smaller portions and try to restrict their dietary intake.[83-85] Interestingly, girls and women tend to restrict dietary intake to lose weight, making them more prone to eating disorders and nutrient deficiencies, while men tend to increase physical activity to lose weight and stay healthy.[84]

The mean overall scores for the main meals, as well as those for appearance, smell, texture and taste for males and females showed that for the *Risotto*, *Pineapple Chicken*, *Indian Pork Dish*, *Bobotie* and *Beef Kebabs* the scores were more or less the same, with no significant differences between the two subgroups. Significant differences were found between the males and females for the *Fish and Vegetable Pie* as well as the *Chicken Pilaf,* with the females showing a greater preference for these dishes than the males. It is however interesting to note that the females gave higher scores, although not significantly different, for

the *Vegetable Lasagna*, *Vegetable Paella* and the *Greenbean Stew* than the males did. This may be attributed to the fact that men tend to prefer meals containing a substantial amount of protein in the form of meat and may dislike main meals that contain only vegetables or a large number of vegetables.

When comparing the mean overall, appearance, smell, texture and taste scores for the side dishes, the males showed a greater preference, although not significantly different, for the *Wheat and Mushroom Casserole*, *Vegetarian Mushroom Dish* as well as the *Curried Wheat Salad*, than the females did. On the other hand, the females showed a greater preference, although not significant, for the *Greenbean, Pea and Mushroom Salad*, *Cabbage Pot*, *Peas in Lemon and Mint Sauce*, *Potato Fritters* and the *Brussels Sprouts with Tomato and Onion Sauce* than the males. Therefore, it can be assumed, that the males preferred the starch-based side dishes while the females preferred the vegetable-based side dishes with the exception of the *Potato Fritters*. The latter may be due to the fact that girls and women are more interested in weight control and more concerned with slimness and nutrition than men are.[83] Recipes containing more vegetables may be perceived as more healthy and nutritious. In a study done by Reicks *et al*. where the researchers investigated the factors affecting the consumption of fruits and vegetables by low-income families, it was shown that the participants of the study and their families were more likely to eat vegetables when sauces, dips and seasonings were added to the food to mask the taste of the vegetables. Although, by adding certain sauces and dips, the fat content of the dish is more likely to increase greatly.[86]

The mean overall scores for desserts and sweets, as well as those for appearance, smell, texture and taste for the males and females showed that the females had a greater preference, although not always significantly different, for the fruit-based desserts, including the *Fruit Jelly*, *Fruit Kebabs*, *Fruit Salad*, *Baked Apple pudding* and the *Baked Apples in Custard Sauce* while the males preferred the sweets containing more fat and sugar such as the *Date Fingers* and the *Marie Biscuit Fudge*. This again, may be due to the fact that the females perceived the fruit-based desserts to be healthier than the other desserts and sweets tested.

The rejection or acceptance of the null-hypothesis stating that there is no significant difference between the male and female participants' responses in the consumer sensory testing is shown in Table 4.1.

Table 4.1: Null-hypothesis accepted or rejected for gender

	Overall score	Appearance Score	Smell Score	Texture Score	Taste Score
Main meals:					
Risotto	Accepted	Accepted	Accepted	Accepted	Accepted
Pineapple Chicken	Accepted	Accepted	Accepted	Accepted	Accepted
Indian Pork Dish	Accepted	Accepted	Accepted	Accepted	Accepted
Bobotie	Accepted	Accepted	Accepted	Accepted	Accepted
Beef Kebabs	Accepted	Accepted	Accepted	Accepted	Accepted
Vegetable Lasagna	Accepted	Accepted	Accepted	Accepted	Accepted
Vegetable Paella	Accepted	Accepted	Accepted	Accepted	Accepted
Fish and Vegetable Pie	Rejected	Rejected	Rejected	Rejected	Rejected
Chicken Pilaf	Rejected	Rejected	Rejected	Rejected	Rejected
Greenbean Stew	Accepted	Accepted	Accepted	Accepted	Accepted
Side dishes:					
Pumpkin Fritters	Accepted	Accepted	Accepted	Accepted	Accepted
Greenbean, Pea and Mushroom Salad	Accepted	Accepted	Accepted	Accepted	Accepted
Rice Salad	Accepted	Accepted	Accepted	Accepted	Accepted
Wheat and Mushroom Casserole	Accepted	Accepted	Accepted	Accepted	Accepted
Cabbage Pot	Accepted	Accepted	Accepted	Accepted	Accepted
Vegetarian Mushroom Dish	Accepted	Accepted	Accepted	Accepted	Accepted
Peas in Lemon and Mint Sauce	Accepted	Accepted	Accepted	Accepted	Accepted
Potato Fritters	Accepted	Accepted	Accepted	Accepted	Accepted
Brussels Sprouts in Tomato and Onion Sauce	Accepted	Accepted	Accepted	Accepted	Accepted
Curried Wheat Salad	Accepted	Accepted	Accepted	Accepted	Accepted
Desserts and sweets:					
Date Fingers	Rejected	Rejected	Rejected	Rejected	Rejected
Fruit Jelly	Accepted	Accepted	Accepted	Accepted	Accepted
Coconut Ice	Accepted	Accepted	Accepted	Accepted	Accepted
Fruit Kebabs	Accepted	Rejected	Accepted	Accepted	Accepted
Marie Biscuit Fudge	Accepted	Accepted	Accepted	Accepted	Accepted
Fruit Salad	Accepted	Accepted	Accepted	Accepted	Accepted
Cinnamon Sugar Pancakes	Accepted	Accepted	Accepted	Accepted	Accepted
Poached Pears	Accepted	Accepted	Accepted	Accepted	Accepted
Baked Apple Pudding	Accepted	Accepted	Accepted	Accepted	Accepted
Baked Apples in Custard Sauce	Accepted	Accepted	Accepted	Accepted	Accepted

Scores for race:

Culture, beliefs, religion and ethnicity play a large role in the eating patterns and diets of all people.[81] Specific cultural, religious and ethnic groups have their own set of dietary practices and these rules can have an important effect on access to food, food choices, preparation and storage methods. Cultural aspects of dietary planning include vegetarianism, ethnic heritage practices and religious customs or rules.[87]

When looking at the study population and the participants who took part in the study it is important to take into consideration the above-mentioned aspects since these most certainly affected their food preferences and scoring of recipes.

The majority of the participants were coloured, while a small number of participants were white and the rest black. Although religion and heritage were not determined, it is very likely that some participants were Christian, Muslim or Jewish as well as Indian, Xhosa or Zulu. Depending on the culture or religion of the participant, some may not, for instance, include pork in the diet, while others may not include fish. Some participants may have been vegetarian, while others simply do not prefer certain dishes due to their culture, heritage or individual preferences. Therefore it was important to distinguish between recipes chosen for the westernised population - including the coloureds, whites and particularly blacks who follow a westernised diet - and recipes for the black population following a traditional diet, as well as recipes for the Indian population.

For the purpose of this study, the main focus was to identify and test recipes for those living in the Western Cape and following a westernised diet. Although black participants were also included in the study, it is important to note that the recipes chosen did not take the preferences and culture of the black population, who follow a traditional diet, into consideration. Traditional meals for the black African such as the one main dish which comprises a bulky carbohydrate (usually mealie meal), supplemented by a side dish (for example a meat stew, a vegetable and sour milk),[81] were not included as recipes to be tested and evaluated by this study population, as this will be investigated in the next phase of the project.

When comparing the mean overall scores for the main meals, appearance, smell, texture and taste, the coloured and white subgroup showed a greater preference, although not significant, for almost all recipes, except the *Bobotie* and *Fish and Vegetable Pie*. This may be due to the fact that popular recipes within the westernised culture were initially chosen to be tested. It is interesting however, that the black subgroup had a slightly higher mean

overall score for *Bobotie* than the westernised subgroup, although *Bobotie* is considered a very popular South African dish within the westernised population.

The mean overall scores for side dishes, as well as those for appearance, smell, texture and taste again showed that the westernised subgroup gave a higher mean score for the majority of the recipes except for the *Greenbean, Pea and Mushroom Salad* and *Cabbage Pot* where the scores were very similar. The westernised subgroup showed a significantly greater preference for the *Rice Salad*, *Wheat and Mushroom Casserole* as well as the *Curried Wheat Salad*. This may be attributed to the black population's probable preference for mealie meal and samp as a starch, rather than rice and wheat.

Except for the *Marie Biscuit Fudge*, the black subgroup gave lower (although not significantly lower scores for all desserts and sweets) mean overall, appearance, smell, texture and taste scores than the westernised subgroup for all desserts and sweets. This again may be due to the reasons previously stated.

When comparing the mean scores of the black participants with the scores of the coloured and white participants for all recipes, taking into consideration the small sample size of the black participants, it is clear that one cannot assume that the black population living in urban areas in the Western Cape follow a westernised diet, due to the overall lower scores given by the black subgroup for most recipes. There is thus a need to develop recipes specifically for the black population following a traditional diet.

The rejection or acceptance of the null-hypothesis, stating that there is no significant difference between the different races of the participants and their responses in the consumer sensory testing is shown in Table 4.2.

Table 4.2: Null-hypothesis accepted or rejected for race

	Overall score	**Appearance Score**	**Smell Score**	**Texture Score**	**Taste Score**
Main meals:					
Risotto	Accepted	Accepted	Accepted	Accepted	Accepted
Pineapple Chicken	Accepted	Accepted	Accepted	Accepted	Accepted
Indian Pork Dish	Accepted	Accepted	Accepted	Accepted	Accepted
Bobotie	Accepted	Accepted	Accepted	Accepted	Accepted
Beef Kebabs	Accepted	Accepted	Accepted	Accepted	Accepted
Vegetable Lasagna	Accepted	Accepted	Accepted	Accepted	Accepted
Vegetable Paella	Accepted	Accepted	Accepted	Accepted	Accepted

	Overall score	Appearance Score	Smell Score	Texture Score	Taste Score
Fish and Vegetable Pie	Accepted	Accepted	Accepted	Accepted	Accepted
Chicken Pilaf	Accepted	Accepted	Accepted	Accepted	Accepted
Greenbean Stew	Accepted	Accepted	Accepted	Accepted	Accepted
Side dishes:					
Pumpkin Fritters	Accepted	Accepted	Accepted	Accepted	Accepted
Greenbean, Pea and Mushroom Salad	Accepted	Accepted	Accepted	Accepted	Accepted
Rice Salad	Rejected	Rejected	Rejected	Rejected	Rejected
Wheat and Mushroom Casserole	Rejected	Rejected	Rejected	Rejected	Rejected
Cabbage Pot	Accepted	Accepted	Accepted	Accepted	Accepted
Vegetarian Mushroom Dish	Accepted	Accepted	Accepted	Accepted	Accepted
Peas in Lemon and Mint Sauce	Accepted	Accepted	Accepted	Accepted	Accepted
Potato Fritters	Accepted	Accepted	Accepted	Accepted	Accepted
Brussels Sprouts in Tomato and Onion Sauce	Accepted	Accepted	Accepted	Accepted	Accepted
Curried Wheat Salad	Rejected	Accepted	Accepted	Accepted	Rejected
Desserts and sweets:					
Date Fingers	Accepted	Accepted	Accepted	Accepted	Accepted
Fruit Jelly	Accepted	Accepted	Accepted	Accepted	Accepted
Coconut Ice	Rejected	Rejected	Rejected	Rejected	Rejected
Fruit Kebabs	Accepted	Rejected	Accepted	Accepted	Accepted
Marie Biscuit Fudge	Accepted	Accepted	Accepted	Accepted	Accepted
Fruit Salad	Accepted	Accepted	Accepted	Accepted	Accepted
Cinnamon Sugar Pancakes	Accepted	Accepted	Accepted	Accepted	Accepted
Poached Pears	Accepted	Accepted	Accepted	Accepted	Accepted
Baked Apple Pudding	Accepted	Accepted	Accepted	Accepted	Accepted
Baked Apples in Custard Sauce	Accepted	Accepted	Accepted	Accepted	Accepted

Implications for the renal dietitian:

Before commencing with dietary counseling, it is important for the dietitian to ensure that the renal patient is ready for change, thus improving the chances of sustained behavioural change. The Stages of Change Model can be used by the dietitian to determine the patients' readiness for change. Dietary counseling and resultant adaptations can only commence once the patient finds himself in the "Action" phase. Ideally, if the patient finds himself in the Pre-contemplation, Contemplation or Preparation phases – the dietitian should only discuss the basic key concepts of the dietary prescription, while referring the patient back to the doctor or to a psychologist.

From the findings of this study, it is clear that menu planning and recipe ideas, for the renal dietitian who is prescribing a diet for the patient with CRF, may be a challenging and daunting task. Not only should the diet prescription be suitable for the renal patient, taking into consideration their dietary restrictions and risk for low nutritional intake and malnutrition, but individual preferences, gender, ethnicity, religion and cultural beliefs should also be considered. It was shown that recipes containing higher amounts of fat and kilojoules are preferred by patients, and this poses a further challenge to the dietitian, to include acceptable, tasty recipe ideas that are still considered healthy. Patients with renal disease have the basic need for an appealing and appetising diet and nutritional intake will be considerably affected if the diet does not meet these needs. Recipes developed specifically for renal patients from different cultural groups within the South African context, are not readily available, at present.

Renal dietitians should take the time, if possible, to not only hand out diet sheets and a diet prescription to patients, but also to suggest practical and appropriate recipes and ideas of how to include these recipes in their everyday lives. These practical tips will make it easier for renal patients to fit into society and not to feel as though their diet is excluding them from meals with their family and friends.

4.4 STUDY LIMITATIONS

Sample representation: Only one facility was chosen for data collection due to requirements in terms of food safety, transportation, facility and financial reasons. The results can therefore not be generalized to all population groups in South Africa.

Sample size: Although a sample size of 35 patients is considered sufficient and has been successfully used for the purposes of consumer sensory evaluation in the past,[71] the researcher would recommend a larger sample size because of the large number of patients who declined to take part due to illness, or did not show up for dialysis on certain days. Because of these unpredictable factors, the sample size varied between 32 and 36 patients for different testing days.

Sample demographics: Since there was a very small number of white participants, significant differences between all races could not be determined, and the coloured and white participants were therefore grouped together to form one subgroup i.e. the westernised subgroup. However, due to the location of data collection, this could not have been prevented. The black subgroup was also small compared to the westernised subgroup. If an

equal number of black, white and coloured participants had been included, the overall scores for dishes may have been lower, because of the observed tendency of the black participants to give lower scores than the westernised subgroup.

Reproducibility of the 9-point hedonic scale: Although the reproducibility of the 9-point hedonic scale was found to be acceptable in other study populations, the reproducibility of the scale was not determined for this specific study population due to logistical, time and financial constraints. Results from this study should therefore be interpreted with caution.

Environment: It should be taken into consideration that the environment in which sensory evaluation takes place can possibly affect the scoring of the different recipes.[62] During data collection, it was observed by the researcher, that patients talked to one another during sensory evaluation and may therefore have influenced each other's responses to the different recipes. Sensory evaluation should ideally take place in a quiet, isolated area, where the panel member can focus on the task at hand and not be disturbed by fellow panel members. During data collection in the ward, nursing staff and doctors were also interrupting sensory evaluation due to conduct ward rounds, to draw blood, check equipment etc. Although none of the above-mentioned factors could be controlled for logistical and practical reasons, they should however be taken into consideration when interpreting the final results of the sensory evaluation.

Untrained panel members: The patients who took part in the sensory evaluation were untrained in sensory evaluation techniques. Although the evaluation form was explained to all patients before sensory evaluation, the patients found it difficult to score each sensory attribute individually. It is evident from the results of the sensory evaluation questionnaires that patients gave the same score for all sensory attributes. However, due to the fact that the acceptability of the recipes was tested, and required a consumer sensory evaluation technique with untrained panel members, this was expected.

Patient nausea: During sensory evaluation patients often stated that they felt nauseous and although some of the patients declined to take part on certain testing days due to feeling too ill, others expressed the wish nevertheless to take part in the evaluation. This may however have affected their scoring of the different recipes, as high fat and sugar containing recipes may have worsened their nausea and negatively affected their scoring of the recipe.

Taste changes: Possible taste changes in HD and CAPD patients can occur, although it has been shown that taste can improve immediately after dialysis.[54] Due to this fact, participants

may have scored dishes differently, depending on whether they performed the sensory evaluation at the beginning of dialysis or towards the end of dialysis.

Satiety of the patient: For logistical reasons, sensory evaluation was performed in the mornings and afternoons after breakfast and lunch. At this time of the day, patients have just consumed a full meal and satiety may have negatively affected the scoring of the recipes. Ideally, sensory evaluation should have taken place between meals to avoid patients being either too hungry or too full.

Despite the study limitations, the researcher is confident that the recipes, that received an overall score of 6 or more by more than 80% of the study participants, can be prescribed by the renal dietitian and will be acceptable to the majority of patients following a westernised diet. Exceptions might be expected in a minority of patients due to individual food preference and eating habits.

CHAPTER 5: CONCLUSIONS AND RECOMMENDATIONS

In this study, 30 recipes were identified and adapted to suit the nutritional requirements and tastes of renal patients following a westernised diet. Adaptations were made for portion size, protein, fat and carbohydrate content, potassium, sodium and phosphate. Although taste abnormalities in renal patients are well documented, the findings in the literature are inconsistent and conflicting and could therefore not be taken into account when adapting the recipes.[50,51,53-57] Further research in this area is therefore needed, before taste abnormalities can be taken into account when adapting recipes for renal patients.

Of the thirty recipes evaluated using the consumer sensory evaluation method, 7 were excluded due to receiving an unacceptable score of 6 or more by fewer than 80% of the study participants. Twenty-three recipes were deemed acceptable and were therefore recommended for inclusion in the Renal Smart Software Programme.

Some significant differences were found between the male and female subgroups' responses. Men tended to give higher scores (although not always significantly different) for the protein-rich foods as well as the starch-based side dishes and sweets, while the women tended to give higher scores (although not always significantly different) for the vegetable-based dishes as well as the desserts containing fruit.

Significant differences between the different races were found. It was shown that the westernised subgroup tended to score all dishes higher than the black subgroup, with the exception of only a few. This may be attributed to the fact that recipes were originally chosen specifically to suit the westernised participants.

There is a definite need to develop recipes to suit the different culture groups within South Africa. Recipes for black renal patients, following a traditional diet, and Indian renal patients are still not readily available. As a result of the current lack of available recipes, renal dietitians face a major challenge when giving practical advice and appropriate recipe ideas to their patients. The researcher recommends that recipes for the traditional black renal patient, as well as for the Indian renal patient, be developed as soon as possible.

The recipes, developed by the researcher, can be used by dietitians as part of their dietary prescription for renal patients following a westernised diet. The proposed recipes to be included in the Renal Smart Programme can be accessed freely by dietitians and patients on the Renal Smart website.

For the development and testing process of future recipes, the following is recommended:

- Renal dietitians working in the area targeted for recipe development and testing should give input on the types of recipes requested by their patients.

- Dialysis facilities across the province should be included, if possible, to obtain a representative sample of all dialysis patients, following a westernised diet, in the Western Cape.

- If possible, a larger pool of dialysis patients should be used during the sensory testing because of the large number of patients who declined to take part on the day due to illness. The sample number is also affected by some patients who do not show up for every dialysis session.

- An almost equal distribution of males and females should be used during sensory evaluation, as it is known that males and females prefer different dishes.

- If the sensory evaluation is done by more than one race group, the aim should be to try and include an equal number of patients from all of the racial groups involved. Only then can the difference in their responses be assessed optimally.

- It is recommended that an extra day be allocated at the beginning of the data collection period for the signing of the consent forms. This will help to speed up the process on the first and second day of sensory evaluation and will prevent the food from becoming cold while patients read and sign consent forms.

- Due to the tendency of patients to score all sensory attributes the same (including appearance, smell, texture and taste), the researcher recommends that only one overall attribute be evaluated, i.e. the overall acceptability of the dish. This will still give a true reflection of the participants' overall opinion of the recipe, but will reduce the amount of time per evaluation as well as fatigue caused by reading through the whole sensory evaluation form.

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APPENDICES

Appendix 6.1

PARTICIPANT INFORMATION LEAFLET AND CONSENT FORM

The development and testing of recipes for patients with chronic renal failure.

REFERENCE NUMBER:

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You are being invited to take part in a research project. Please take some time to read the information presented here, which will explain the details of this project. Please ask the study staff any questions about any part of this project that you do not fully understand. It is very important that you are fully satisfied that you clearly understand what this research entails and how you could be involved. Also, your participation is **entirely voluntary** and you are free to decline to participate. If you say no, this will not affect you negatively in any way whatsoever. You are free to withdraw from the study at any point, even if you do agree to take part.

This study has been approved by the **Committee for Human Research at Stellenbosch University** and will be conducted according to the ethical guidelines and principles of the international Declaration of Helsinki, South African Guidelines for Good Clinical Practice and the Medical Research Council (MRC) Ethical Guidelines for Research.

What is the research all about?

The study aims to develop and test recipes for patients with chronic renal failure. Dialysis patients that visit Tygerberg Academic Hospital, Cape Town, South Africa are invited to take part in the study if they have been diagnosed with advanced chronic renal failure and meet the inclusion criteria for the study.

Who have been invited to participate?

Fourty dialysis patients from the dialysis unit in Tygerberg Academic Hospital will be invited to take part at each tasting.

What will your responsibilities be?

Participants will be asked to taste three recipes that were prepared in the Tygerberg Academic Hospital special diets kitchen and complete a self-administered questionnaire with regard to the overall acceptance, appearance, smell, texture and taste of each recipe.

Will you benefit from taking part in this research?

Depending on the response from the participants, suitable recipes will be adapted and analysed for patients with chronic renal failure. Recipes will be made available to dietitians to recommend to their patients.

Are there any risks involved in taking part in this study?

No risks are foreseen with this study. Special care will be taken to ensure that all recipes are prepared according to the strictest hygienic standards and are suited for the patient with chronic renal failure.

Will you be paid to take part in this study and are there any costs involved?

No participant will receive remuneration for taking part in this study and there will be no costs involved for you.

Is there anything else that you should know or do?

- You can contact the Committee for Human Research at 021-938 9207 if you have any concerns or complaints that have not been adequately addressed by the study staff.
- You will receive a copy of this information and consent form for your own records.
- All identification information will be omitted from the study to ensure confidentiality. Upon entering the study, each participant will receive an identification number which will be used on all study related material.

Declaration by participant

By signing below, I …… agree to take part in a research study entitled "The development and testing of recipes for patients with chronic renal failure."

I declare that:
- I have read this information and consent form and it is written in a language with which I am fluent and comfortable.
- I have had a chance to ask questions and all my questions have been adequately answered.
- I understand that taking part in this study is **voluntary** and I have not been pressurised to take part.
- I may choose to leave the study at any time and will not be penalized or prejudiced in any way.

Signed at (place) ……on (date) ……2008.

…….. ……
Signature of participant **Signature of witness**

Declaration by investigator

I (name) …… declare that:
- I explained the information in this document to ……..
- I encouraged him/her to ask questions and took adequate time to answer them.
- I am satisfied that he/she adequately understands all aspects of the research, as discussed above

Signed at (place) ……on (date) ……2008.

…… …….
Signature of investigator **Signature of witness**

Appendix 6.2

DEELNEMERINLIGTINGSBLAD EN –TOESTEMMINGSVORM

Die ontwikkeling en toetsing van resepte vir pasiënte met chroniese nierversaking.

VERWYSINGSNOMMER:

HOOF NAVORSER: Me Nelene Conradie

ADRES: Afdeling Menslike Voeding
Departement Interdissiplinêre Gesondheidswetenskappe
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U word genooi om deel te neem aan 'n navorsingsprojek. Lees asseblief hierdie inligtingsblad op u tyd deur aangesien die detail van die navorsingsprojek daarin verduidelik word. Indien daar enige deel van die navorsingsprojek is wat u nie ten volle verstaan nie, is u welkom om die navorsingspersoneel daaroor uit te vra. Dit is baie belangrik dat u ten volle moet verstaan wat die navorsingsprojek behels en hoe u daarby betrokke kan wees. U deelname is ook **volkome vrywillig** en dit staan u vry om deelname te weier. U sal op geen wyse hoegenaamd negatief beïnvloed word indien u sou weier om deel te neem nie. U mag ook te eniger tyd aan die navorsingsprojek onttrek, selfs al het u ingestem om deel te neem.

Hierdie navorsingsprojek is deur die **Komitee vir Mensnavorsing van die Universiteit Stellenbosch** goedgekeur en sal uitgevoer word volgens die etiese riglyne en beginsels van die Internasionale Verklaring van Helsinki en die Etiese Riglyne vir Navorsing van die Mediese Navorsingsraad (MNR).

Wat behels hierdie navorsingsprojek?

Die studie beoog om resepte te ontwikkel en uit te toets vir pasiënte met chroniese nierversaking. Dialise pasiënte wat Tygerberg Akademiese Hospitaal, Kaapstad, Suid-Afrika besoek word uitgenooi om aan die studie deel te neem as hulle gediagnoseer is met gevorderde chroniese nierversaking en voldoen aan die insluitingskriteria.

Wie is genooi om deel te neem?

Veertig dialise pasiënte van die dialise eenheid in Tygerberg Akademiese Hospitaal sal genooi word om deel te neem by elke proesessie.

Wat sal u verantwoordelikhede wees?

Deelnemers sal gevra word om drie resepte te proe wat voorberei is in Tygerberg Akademiese Hospitaal se spesiale dieetkombuis en om 'n self-voltooide vraelys in te vul oor die algehele aanvaarbaarheid, voorkoms, reuk, tekstuur en smaak van elke resep.

Sal u voordeel trek deur deel te neem aan hierdie navorsingsprojek?

Afhangende van die respons van die deelnemers sal geskikte resepte vir pasiënte met chroniese nierversaking aangepas en geanaliseer word. Resepte sal beskikbaar gemaak word aan dieetkundiges om vir hul pasiënte aan te beveel.

Is daar enige risiko's aan verbonde aan u deelname aan hierdie navorsingsprojek?

Geen risiko's word vir die studie voorsien nie. Spesiale voorsorg sal geneem word om te verseker dat alle resepte voorberei word volgens die strengste higiëniese standaarde en dat dit geskik is vir pasiënte met chroniese nierversaking.

Sal u betaal word vir u deelname aan die navorsingsprojek en is daar enige koste verbonde aan deelname?

Geen deelnemer sal betaling ontvang vir hul deelname aan hierdie studie nie en u hoef ook nie enige uitgawes aan te gaan nie.

Is daar enigeiets anders wat u moet weet of doen?

- U kan die Komitee vir Mensnavorsing kontak by 021-938 9207 indien u enige bekommernis of klagte het wat nie bevredigend deur u studie personeel hanteer is nie.

- U sal 'n afskrif van hierdie inligtings- en toestemmingsvorm ontvang vir u eie rekords.

- Alle identifikasie informasie sal uitgelaat word uit die studie om konfidensialiteit te verseker. Wanneer 'n deelnemer toegelaat word tot die studie, ontvang hy/sy 'n verwysingsnommer wat gebruik word op alle verwante studiemateriaal.

Verklaring deur deelnemer

Met die ondertekening van hierdie dokument onderneem ek, …… om deel te neem aan 'n navorsingsprojek getiteld "Die ontwikkeling en toetsing van resepte vir pasiënte met chroniese nierversaking."

Ek verklaar dat:
- Ek hierdie inligtings- en toestemmingsvorm gelees het en dat dit in 'n taal geskryf is waarin ek vaardig en gemaklik mee is.
- Ek geleentheid gehad het om vrae te stel en dat al my vrae bevredigend beantwood is.
- Ek verstaan dat deelname aan hierdie navorsingsprojek **vrywillig** is en dat daar geen druk op my geplaas is om deel te neem nie.
- Ek te eniger tyd aan die navorsingsprojek mag onttrek en dat ek nie op enige wyse daardeur benadeel sal word nie.

Geteken te (plek) ……op (datum) ……2008.

…….. ……
Handtekening van deelnemer **Handtekening van getuie**

Verklaring deur navorser

Ek (naam) …… verklaar dat:
- Ek die inligting in hierdie dokument verduidelik het aan ……
- Ek hom/haar aangemoedig het om vrae te vra en voldoende tyd gebruik het om dit te beantwoord.
- Ek tevrede is dat die deelnemer die inhoud van hierdie dokument ten volle verstaan en dat al sy/haar vrae bevredigend beantwoord is.

Geteken te (plek) ……op (datum) ……2008.

....
Handtekening van navorser **Handtekening van getuie**

Appendix 6.3

Sensory Evaluation Questionnaire

Researcher: Me N Conradie

The development and testing of recipes for patients with chronic renal failure

Date:	
Recipe:	
Reference number:	

Instructions:

- Please rinse your mouth before starting if possible.

1. Evaluate the product in front of you by looking at it. Indicate how much you like or dislike the following aspect: (check the box that best represents your response)

Overall appearance

- ☐ Like extremely
- ☐ Like very much
- ☐ Like moderately
- ☐ Like slightly
- ☐ Neither like nor dislike
- ☐ Dislike slightly
- ☐ Dislike moderately
- ☐ Dislike very much
- ☐ Dislike extremely

2. Evaluate the product in front of you by smelling it. Indicate how much you like or dislike the following aspect: (check the box that best represents your response)

Overall smell

- ☐ Like extremely
- ☐ Like very much
- ☐ Like moderately
- ☐ Like slightly
- ☐ Neither like nor dislike
- ☐ Dislike slightly
- ☐ Dislike moderately
- ☐ Dislike very much
- ☐ Dislike extremely

Please turn the page…

Recipe: | |

3. Evaluate the product in front of you by tasting it. Indicate how much you like or dislike the following aspect: (check the box that best represents your response)

Overall texture (how it feels in the mouth)

- ☐ Like extremely
- ☐ Like very much
- ☐ Like moderately
- ☐ Like slightly
- ☐ Neither like nor dislike
- ☐ Dislike slightly
- ☐ Dislike moderately
- ☐ Dislike very much
- ☐ Dislike extremely

4. Evaluate the product in front of you by tasting it. Indicate how much you like or dislike the following aspect: (check the box that best represents your response)

Overall taste

- ☐ Like extremely
- ☐ Like very much
- ☐ Like moderately
- ☐ Like slightly
- ☐ Neither like nor dislike
- ☐ Dislike slightly
- ☐ Dislike moderately
- ☐ Dislike very much
- ☐ Dislike extremely

5. While considering **ALL THE CHARACTERISTICS** (including appearance, smell, texture and taste), please indicate your overall opinion by checking **ONE** box.

- ☐ Like extremely
- ☐ Like very much
- ☐ Like moderately
- ☐ Like slightly
- ☐ Neither like nor dislike
- ☐ Dislike slightly
- ☐ Dislike moderately
- ☐ Dislike very much
- ☐ Dislike extremely

Thank you very much for your participation!

Appendix 6.4

Sensoriese Evaluering Vraelys

Navorser: Me N Conradie

Die ontwikkeling en toetsing van resepte vir pasiënte met chroniese nierversaking

Datum:	
Resep:	
Verwysingsnommer:	

Instruksies:

- Spoel asseblief u mond met water voor u begin, indien moontlik.

1. Evalueer die produk voor u, deur daarna te kyk. Dui aan hoeveel u van die volgende aspek hou of nie van hou nie: (merk die boksie wat u reaksie die beste verteenwoordig)

Algehele voorkoms

- ☐ Uitermatige voorkeur
- ☐ Sterk voorkeur
- ☐ Matige voorkeur
- ☐ Effense voorkeur
- ☐ Geen voorkeur of afkeur
- ☐ Effense afkeur
- ☐ Matige afkeur
- ☐ Sterk afkeur
- ☐ Uitermatige afkeur

2. Evalueer die produk voor u, deur daaraan te ruik. Dui aan hoeveel u van die volgende aspek hou of nie van hou nie: (merk die boksie wat u reaksie die beste verteenwoordig)

Algehele reuk

- ☐ Uitermatige voorkeur
- ☐ Sterk voorkeur
- ☐ Matige voorkeur
- ☐ Effense voorkeur
- ☐ Geen voorkeur of afkeur
- ☐ Effense afkeur
- ☐ Matige afkeur
- ☐ Sterk afkeur
- ☐ Uitermatige afkeur

Blaai asseblief om….

Resep: | |

3. Evalueer die produk voor u, deur daaraan te proe. Dui aan hoeveel u van die volgende aspek hou of nie van hou nie: (merk die boksie wat u reaksie die beste verteenwoordig)

Algehele tekstuur (hoe dit in die mond voel)

- [ ] Uitermatige voorkeur
- [ ] Sterk voorkeur
- [ ] Matige voorkeur
- [ ] Effense voorkeur
- [ ] Geen voorkeur of afkeur
- [ ] Effense afkeur
- [ ] Matige afkeur
- [ ] Sterk afkeur
- [ ] Uitermatige afkeur

4. Evalueer die produk voor u, deur daaraan te proe. Dui aan hoeveel u van die volgende aspek hou of nie van hou nie: (merk die boksie wat u reaksie die beste verteenwoordig)

Algehele smaak

- [ ] Uitermatige voorkeur
- [ ] Sterk voorkeur
- [ ] Matige voorkeur
- [ ] Effense voorkeur
- [ ] Geen voorkeur of afkeur
- [ ] Effense afkeur
- [ ] Matige afkeur
- [ ] Sterk afkeur
- [ ] Uitermatige afkeur

5. Terwyl u **AL DIE EIENSKAPPE** (insluitende voorkoms, reuk, tekstuur en smaak) in ag neem, dui asseblief u algehele opinie aan deur **EEN** van die volgende blokkies te merk.

- [ ] Uitermatige voorkeur
- [ ] Sterk voorkeur
- [ ] Matige voorkeur
- [ ] Effense voorkeur
- [ ] Geen voorkeur of afkeur
- [ ] Effense afkeur
- [ ] Matige afkeur
- [ ] Sterk afkeur
- [ ] Uitermatige afkeur

Baie dankie vir u deelname!

Appendix 6.5

20 November 2007

Ms N Conradie
Division of Human Nutrition
Dept of Interdisciplinary Health Sciences

Dear Ms Conradie

RESEARCH PROJECT : "THE DEVELOPMENT AND TESTING OF RECIPES FOR PATIENTS WITH CHRONIC RENAL FAILURE"
PROJECT NUMBER : N07/10/220

My letter dated 18 October 2007 refers.

At a meeting that was held on 12 November 2007 the Committee for Human Research ratified the approval of the abovementioned project.

Yours faithfully

CJ VAN TONDER
RESEARCH DEVELOPMENT AND SUPPORT (TYGERBERG)
Tel: +27 21 938 9207 / E-mail: cjvt@sun.ac.za

CJVT/pm

Appendix 6.6

Table 6.1: Nutritional analysis and allocated exchanges for recipes

	FOODFINDER ANALYSIS per portion Energy (E) in kilojoules Protein (Prot) in gram Fat (F) in gram Carbohydrate (CHO) in gram Phosphate (P) in milligram Potassium (K) in milligram Sodium (Na) in milligram		**RENAL EXCHANGES per portion**
MAIN MEALS			
Vegetable Lasagna	E: Prot: F: CHO: P: K: Na:	1030 9 16.5 13.4 177 244 134	1 Meat High Phosphate 1 Starch Low Potassium 1 Vegetable Moderate Potassium 1 Fat
Risotto	E: Prot: F: CHO: P: K: Na:	840 6.4 7.7 25.4 130 117 82	1 Meat High Phosphate 1 Starch Low Potassium
Vegetable Paella	E: Prot: F: CHO: P: K: Na:	1234 8 14.9 30.3 164 221 217	1 Meat High Phosphate 1 Starch Low Potassium 1 Vegetable Low Potassium 1 Fat
Pineapple Chicken	E: Prot: F: CHO: P: K: Na:	934 17.3 13.8 5.7 160 355 43	2 Meat Low Phosphate 1 Vegetable Moderate Potassium 2 Fat
Chicken Pilaf	E: Prot: F: CHO: P: K: Na:	917 14.8 4.9 25.3 184 465 36	2 Meat Low Phosphate 1 Starch Low Potassium
Beef Kebabs	E: Prot: F: CHO: P: K: Na:	1484 12.8 20.1 25.7 167 701 111	1 Meat Low Phosphate 1 Vegetable High Potassium 1 Fruit High Potassium 2 Fat

	FOODFINDER ANALYSIS per portion Energy (E) in kilojoules Protein (Prot) in gram Fat (F) in gram Carbohydrate (CHO) in gram Phosphate (P) in milligram Potassium (K) in milligram Sodium (Na) in milligram		**RENAL EXCHANGES per portion**
Greenbean Stew	E: Prot: F: CHO: P: K: Na:	806 11 10.2 10.2 114 441 29	1 Meat Low Phosphate 1 Starch High Phosphate 1 Vegetable Moderate Potassium 1 Fat
Fish and Vegetable Pie	E: Prot: F: CHO: P: K: Na:	1012 15.8 16.3 5.2 121 505 95	2 Meat Low Phosphate 2 Vegetable Moderate Potassium 2 Fat
Bobotie	E: Prot: F: CHO: P: K: Na:	732 14.5 7.6 10.3 143 257 103	1 Meat Low Phosphate 1 Starch Low Phosphate
Indian Pork Dish	E: Prot: F: CHO: P: K: Na:	1214 30.7 16.5 3.9 215 529 380	3 Meat Low Phosphate 1 Vegetable Low Potassium 1 Fat
SIDE DISHES			
Potato Fritters	E: Prot: F: CHO: P: K: Na:	277 1.4 0.1 13 36 255 4	1 Starch High Potassium
Pumpkin Fritters	E: Prot: F: CHO: P: K: Na:	891 1.7 16.4 14.1 140 110 99	1 Vegetable Moderate Potassium 1 Sugar 3 Fat

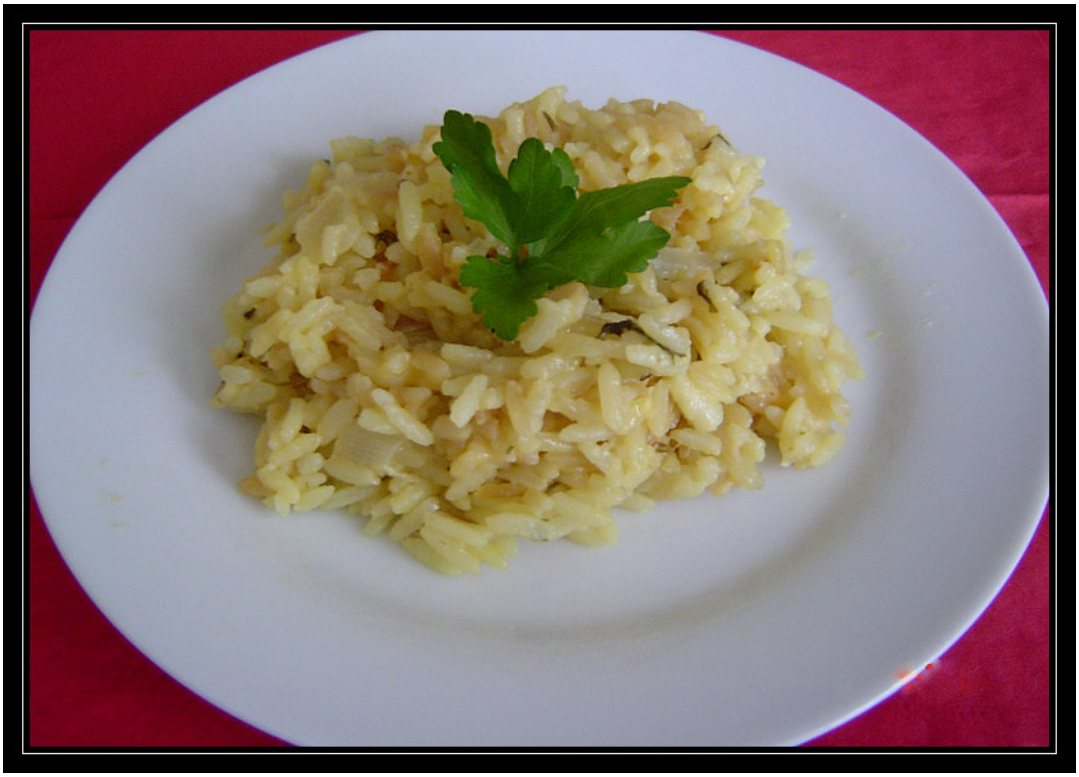
	FOODFINDER ANALYSIS per portion Energy (E) in kilojoules Protein (Prot) in gram Fat (F) in gram Carbohydrate (CHO) in gram Phosphate (P) in milligram Potassium (K) in milligram Sodium (Na) in milligram		**RENAL EXCHANGES per portion**
Wheat and Mushroom Casserole	E: Prot: F: CHO: P: K: Na:	805 4.3 9.4 16.6 86 280 15	1 Starch Low Potassium 1 Vegetable Low Potassium 1 Vegetable High Potassium 2 Fat
Brussels Sprouts with Tomato and Onion Sauce	E: Prot: F: CHO: P: K: Na:	279 1.2 4.6 3.4 29 186 6	1 Vegetable Moderate Potassium 1 Fat
Vegetarian Mushroom Dish	E: Prot: F: CHO: P: K: Na:	1479 14.4 22.1 22.1 261 280 406	1 Meat High Phosphate 1 Starch Low Potassium 1 Vegetable Low Potassium 2 Vegetable Moderate Potassium 3 Fat
Rice Salad	E: Prot: F: CHO: P: K: Na:	439 1.7 1.8 19.2 35 99 45	1 Starch Low Potassium
Peas in Lemon and Mint Sauce	E: Prot: F: CHO: P: K: Na:	583 4.1 8.8 6.4 62 201 50	2 Vegetable Low Potassium 1 Fat
Greenbean, Pea and Mushroom Salad	E: Prot: F: CHO: P: K: Na:	643 7.8 4.2 12.3 133 437 9	2 Vegetable Low Potassium 2 Vegetable Moderate Potassium 1 Fat

	FOODFINDER ANALYSIS per portion Energy (E) in kilojoules Protein (Prot) in gram Fat (F) in gram Carbohydrate (CHO) in gram Phosphate (P) in milligram Potassium (K) in milligram Sodium (Na) in milligram		**RENAL EXCHANGES per portion**
Curried Wheat Salad	E: Prot: F: CHO: P: K: Na:	423 2.1 2.9 13.3 33 143 54	1 Starch High Potassium 1 Fruit Low Potassium
Cabbage Pot	E: Prot: F: CHO: P: K: Na:	532 1.8 7.6 10.7 47 304 30	3 Vegetable Low Potassium 2 Fat
DESSERTS AND SWEETS			
Fruit Salad	E: Prot: F: CHO: P: K: Na:	429 0.8 0.2 20.8 18 212 3	1 Fruit Low Potassium 1 Fruit Moderate Potassium
Fruit Kebabs	E: Prot: F: CHO: P: K: Na:	282 0.6 0.1 13.9 12 144 2	1 Fruit Low Potassium 1 Fruit Moderate Potassium
Baked Apples in Custard Sauce	E: Prot: F: CHO: P: K: Na:	681 0.5 4.5 27.3 13 159 27	2 Fruit Low Potassium 1 Sugar 1 Fat
Fruit Jelly	E: Prot: F: CHO: P: K: Na:	447 1.2 0.1 23.8 10 91 8	1 Fruit Low Potassium 1 Sugar

	FOODFINDER ANALYSIS per portion Energy (E) in kilojoules Protein (Prot) in gram Fat (F) in gram Carbohydrate (CHO) in gram Phosphate (P) in milligram Potassium (K) in milligram Sodium (Na) in milligram		**RENAL EXCHANGES per portion**
Date Fingers	E: Prot: F: CHO: P: K: Na:	760 1.3 10.3 20.3 19 103 77	1 Starch Low Potassium 1 Fat
Coconut Ice	E: Prot: F: CHO: P: K: Na:	657 0.8 5.3 24.9 24 56 7	1½ Sugar
Marie Biscuit Fudge	E: Prot: F: CHO: P: K: Na:	856 1.2 10.1 27.1 18 22 127	1 Starch Low Potassium ½ Sugar 1 Fat
Cinnamon Sugar Pancakes	E: Prot: F: CHO: P: K: Na:	564 1.6 6.3 17.8 57 24 36	1 Starch Low Potassium 1 Fat
Poached Pears	E: Prot: F: CHO: P: K: Na:	202 0.2 0.1 8.8 6 55 2	1 Fruit Low Potassium ½ Sugar
Baked Apple Pudding	E: Prot: F: CHO: P: K: Na:	1264 2.7 9.7 49.7 102 56 196	½ Milk 1 Starch Low Potassium 2 Sugar 1 Fat

Appendix 6.7

Photograph 6.1: Vegetable Lasagna



Photograph 6.2: Risotto

VEGETABLE LASAGNA

Recipe Yield

Total yield: 960g
160g/portion
6 Portions

Ingredients

180g	Spinach, cooked and drained
60ml	Sunflower oil
To taste	Pepper
90g	Onion, chopped
50g	Carrots, grated
30g	Celery
To taste	Garlic cloves
320g	Tomatoes, chopped
15g	Parsley, chopped
5g	Sugar
240g	Noodles, cooked
180g	Cheese, finely grated
To taste	Paprika

Method

Lightly sauté the spinach in half the oil.
Season with pepper and keep aside.
Sauté the onion, carrots, celery, and garlic in the rest of the oil until soft.
Add the tomatoes and parsley and cook until the mixture is dry.
Season with pepper and sugar.
Grease an oven dish with oil and dish layers into the oven dish as follows: half the tomato sauce, half the noodles, half the cheese, the spinach and then the rest of the noodles, tomato sauce and cheese.
Sprinkle paprika over the top and bake for 20 minutes at 180℃.
Serve.

Exchanges per Portion

1 Meat High Phosphate
1 Starch Low Potassium
1 Vegetable Moderate Potassium
1 Fat

Nutritional Analysis

Energy (kJ)	Protein (g)	Fat (g)	CHO (g)	Phosphate (mg)	Potassium (mg)	Sodium (mg)
1030	9	16.5	13.4	177	244	134

RISOTTO

Recipe Yield

Total yield: 1000g
125g/portion
8 Portions

Ingredients

200g	Rice, uncooked
90g	Onion, chopped
90g	Cheese, finely grated
500ml	Water
To taste	Garlic cloves
1g	Rosemary, dried
45g	Parsley, chopped
1g	Saffron
15ml	Sunflower oil

Method

Heat a small amount of oil in a large frying pan and sauté the rice, onion and garlic until golden brown.
Add 250ml of the water and add the herbs and saffron. Mix well.
Allow to simmer over moderate heat and add more water when the mixture cooks dry. Stir occasionally.
When all the fluid has been absorbed by the rice and the rice is soft, add the cheese and mix well. Simmer further until the cheese begins to melt.
Serve immediately.

Exchanges per Portion

1 Meat High Phosphate
1 Starch Low Potassium

Nutritional Analysis

Energy (kJ)	Protein (g)	Fat (g)	CHO (g)	Phosphate (mg)	Potassium (mg)	Sodium (mg)
840	6.4	7.7	25.4	130	117	82

Photograph 6.3: Vegetable Paella

Photograph 6.4: Pineapple Chicken

RenalSmart
Nutritional Information System

VEGETABLE PAELLA

Recipe Yield

Total yield: 1200g
200g/portion
6 Portions

Ingredients

250g	Rice, uncooked
90g	Onion, chopped
160g	Tomatoes, peeled and chopped
50g	Cucumber, peeled and chopped
30g	Celery
75g	Green pepper, seeded and thinly sliced
50ml	Olive oil
1g	Turmeric
600ml	Water, hot
To taste	Garlic cloves
3g	Lemon zest
15g	Parsley, chopped
15g	Thyme, fresh
120g	Cheese, finely grated
1g	Pepper
Garnishing:	
50g	Olives, black, pitted
25g	Chilli or sweet pepper, red, thinly sliced

Method

Heat the oil in a heavy-based frying pan and sauté the rice until it is light yellow.
Add the onion and garlic and sauté for a further 3 minutes.
Mix the saffron and the hot water and add to the pan. Add the tomatoes and allow to simmer for 15 minutes with the lid on.
Stir in the cucumber and celery and allow to simmer for a further 5 minutes.
Stir in the green pepper and allow to simmer for 5 minutes until the rice is just soft and all the fluid is absorbed. Add more hot water if the mixture is too dry.
Remove from heat and stir in the parsley, thyme and lemon zest. Add pepper if preferred.
Dish the mixture out into a casserole dish and garnish with olives and chilli peppers.
Sprinkle the cheese over and place under the grill until the cheese bubbles and browns.
Serve immediately.

Exchanges per Portion

1 Meat High Phosphate
1 Starch Low Potassium
1 Vegetable Low Potassium
1 Fat

Nutritional Analysis

Energy (kJ)	Protein (g)	Fat (g)	CHO (g)	Phosphate (mg)	Potassium (mg)	Sodium (mg)
1234	8	14.9	30.3	164	221	217

PINEAPPLE CHICKEN

Recipe Yield

Total yield: 840g
140g/portion
6 Portions

Ingredients

60ml	Sunflower oil
90g	Onion, chopped
135g	Mushrooms, fresh, chopped
To taste	Pepper
120g	Pineapple, chopped
50g	Green pepper, seeded, sliced in rings
360g	Chicken, without bone, grilled, chopped
10g	Celery
To taste	Pepper
2g	Mixed herbs
3g	Maize flour

Method

Heat the oil in a pan over moderate heat.
Sauté the onions, mushrooms, pineapple, green pepper and celery lightly.
Add the chicken and flavourants and mix. Cook for a few minutes.
Thicken the sauce with maize flour if need be and serve.

Exchanges per Portion

2 Meat Low Phosphate
1 Vegetable Moderate Potassium
2 Fat

Nutritional Analysis

Energy (kJ)	Protein (g)	Fat (g)	CHO (g)	Phosphate (mg)	Potassium (mg)	Sodium (mg)
934	17.3	13.8	5.7	160	355	43

Photograph 6.5: Chicken Pilaf

Photograph 6.6: Beef Kebabs

CHICKEN PILAF

Recipe Yield

Total yield: 1980g
220g/portion
9 Portions

Ingredients

30ml	Sunflower oil
400g	Chicken, without bone, raw, chopped
150g	Onion, chopped
480g	Tomatoes, chopped
100g	Green pepper, seeded, chopped
To taste	Garlic cloves
2g	Mixed herbs
To taste	Paprika
3g	Turmeric
10g	Sugar
200g	Rice, uncooked
150g	Peas
100g	Parsley, chopped

Method

Heat the oil in a pan over moderate heat and sauté the chicken until golden brown.
Remove from the pan and keep aside.
Sauté the onions for 2 to 3 minutes until soft.
Break the chicken into small pieces and keep aside.
Mix the tomato, green pepper, garlic, flavourants and sugar lightly with the onion and bring to a boil.
Add the rice and enough water to cover it and simmer until the rice is cooked.
Add the peas and the pieces of chicken and simmer for a further 5 minutes.
Dish out into a serving dish and sprinkle the chopped parsley over the top.
Serve.

Exchanges per Portion

2 Meat Low Phosphate
1 Starch Low Potassium

Nutritional Analysis

Energy (kJ)	Protein (g)	Fat (g)	CHO (g)	Phosphate (mg)	Potassium (mg)	Sodium (mg)
917	14.8	4.9	25.3	184	465	36

BEEF KEBABS

Recipe Yield

Total yield: 2520g
210g/portion
12 Portions

Ingredients

	Marinade
90g	Onion, chopped
200ml	Sunflower oil
100ml	Vinegar
25g	Jam, apricot
50g	Raisons
100g	Chutney
7.5g	Curry powder
2g	Mixed herbs
	Kebabs
450g	Beef, cubed
300g	Carrots, cut into rings
240g	Peaches, halves, dried
240g	Prunes, seeded
250g	Mushrooms, fresh
12	Kebab sticks

Method

Sauté the onions in the oil until golden brown.
Mix all the remaining ingredients of the sauce and add to the onions. Add a bit of water if necessary.
Marinade the meat, vegetables and fruit in the sauce for a day or two.
Thread onto kebab sticks.
Bake slowly at 160℃ until cooked, turning them occasionally in the sauce.
Serve.

Exchanges per Portion

1 Meat Low Phosphate
1 Vegetable High Potassium
1 Fruit High Potassium
2 Fat

Nutritional Analysis

Energy (kJ)	Protein (g)	Fat (g)	CHO (g)	Phosphate (mg)	Potassium (mg)	Sodium (mg)
1484	12.8	20.1	25.7	167	701	111

Photograph 6.7: Greenbean Stew

Photograph 6.8: Fish and Vegetable Pie

GREENBEAN STEW

Recipe Yield

Total yield: 2400g
200g/portion
12 Portions

Ingredients

500g	Beef, cubed
30ml	Sunflower oil
1kg	Green beans, thinly sliced
400g	Potato, cubed
50g	Green pepper, seeded, chopped
120g	Onion, chopped
5g	Sugar
500ml	Water

Method

Heat the oil in a large pot and sauté the onions and green pepper until the onions are transparent.
Add the meat and brown. Add a small amount of water as needed.
Add the water and allow to simmer for about 1 hour 45 minutes until the meat is almost soft. Add more water as needed.
Then add the green beans and sugar and simmer until the green beans are just about soft. Add more water if necessary.
Add the potatoes and simmer until soft.
Serve.

Exchanges per Portion

1 Meat Low Phosphate
1 Starch High Potassium
1 Vegetable Moderate Potassium
1 Fat

Nutritional Analysis

Energy (kJ)	Protein (g)	Fat (g)	CHO (g)	Phosphate (mg)	Potassium (mg)	Sodium (mg)
806	11	10.2	10.2	114	441	29

FISH AND VEGETABLE PIE

Recipe Yield

Total yield: 1140g
190g/portion
6 Portions

Ingredients

90ml	Sunflower oil
420g	Line fish, cleaned, raw
160g	Cauliflower, cooked
50g	Green pepper, seeded, chopped
160g	Tomatoes, chopped
90g	Onion, chopped
100g	Mushrooms, fresh, sliced
100g	Peas, cooked
To taste	Pepper
2g	Mixed herbs

Method

Heat two thirds of the oil in a pan over moderate heat and sauté the onions until cooked.
Remove from heat and keep aside.
Mash the cauliflower with a fork and dish into a greased oven dish.
Heat the remaining oil and sauté the vegetables lightly for 5 to 7 minutes.
Mix the fish lightly with the vegetables and flavourants and dish into the oven dish over the cauliflower.
Heat in the oven at 180℃ for 10 minutes and serve.

Exchanges per Portion

2 Meat Low Phosphate
2 Vegetable Moderate Potassium
2 Fat

Nutritional Analysis

Energy (kJ)	Protein (g)	Fat (g)	CHO (g)	Phosphate (mg)	Potassium (mg)	Sodium (mg)
1012	15.8	16.3	5.2	121	505	95

Photograph 6.9: Bobotie

Photograph 6.10: Indian Pork Dish

BOBOTIE

Recipe Yield

Total yield: 900g
100g/portion
9 Portions

Ingredients

600g	Mince meat, beef
60g	Onion, chopped
60g	Raisons
20g	Jam, apricot
20g	Chutney
1 slice	Bread, white
10ml	Sunflower oil
3	Eggs, Large
250ml	Milk, Full fat
25ml	Lemon juice
5g	Curry powder
3g	Turmeric
2	Bay leaves

Method

Soak the bread in 125ml of the milk; press the milk out and mix the bread with the mince meat.
Mix all the other ingredients in *except* for the oil, eggs, milk and bay leaves.
Heat the oil in a pan and brown the mince meat mixture lightly.
Dish out into a casserole dish.
Beat the eggs and the rest of the milk lightly and pour over the meat mixture. Garnish with the bay leaves.
Bake in the oven at 180℃ for about 50 minutes.

Exchanges per Portion

1 Meat Low Phosphate
1 Starch Low Phosphate

Nutritional Analysis

Energy (kJ)	Protein (g)	Fat (g)	CHO (g)	Phosphate (mg)	Potassium (mg)	Sodium (mg)
732	15.4	7.6	10.3	143	257	103

INDIAN PORK DISH

Recipe Yield

Total yield: 760g
190g/portion
4 Portions

Ingredients

1 kg	Pork, without fat
5g	Cumin seeds
2	Garlic, cloves
5	Pepper corns
5g	Turmeric
5g	Coriander, Fine
125ml	Vinegar, white
15ml	Sunflower oil
2.5cm	Ginger, finely chopped
2	Chillies, fresh
90g	Onion, chopped
300ml	Stock, beef
2.5g	Pepper, fine

Method

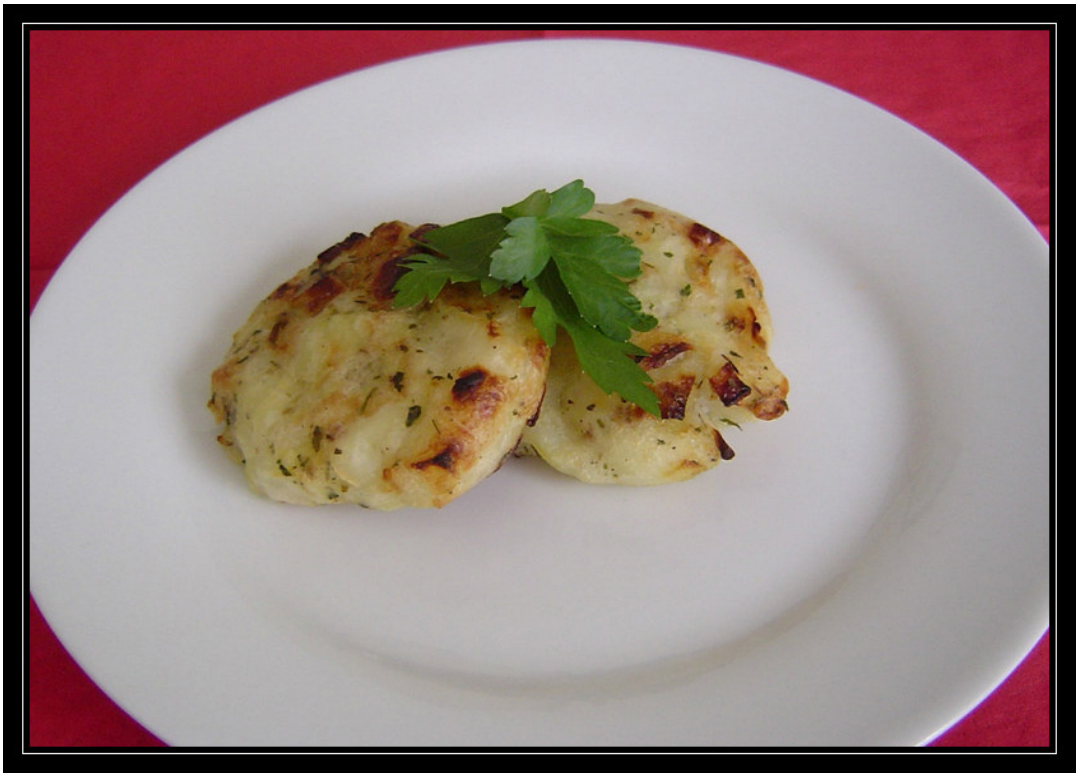
Chop the pork into 5cm blocks.
Finely crush the cumin seeds, garlic and pepper corns together and mix with the turmeric, coriander and vinegar.
Rub the meat with this mixture and allow to marinate over night.
Heat the oil in a pan and sauté the ginger, chilies and onions for 5 minutes.
Drain the oil in a pan and add the pork and marinade.
Pour the beef stock over the meat and heat to boiling point.
Lower the heat, cover and allow to simmer slowly for 1 hour 30 minutes until the meat is soft.
Serve

Exchanges per Portion

3 Meat Low Phosphate
1 Vegetable Low Potassium
1 Fat

Nutritional Analysis

Energy (kJ)	Protein (g)	Fat (g)	CHO (g)	Phosphate (mg)	Potassium (mg)	Sodium (mg)
1214	30.7	16.5	3.9	215	529	380



Photograph 6.11: Potato Fritters

Photograph 6.12: Pumpkin Fritters

POTATO FRITTERS

Recipe Yield

Total yield: 540g
90g/portion
6 Portions of 2 fritters per portion

Ingredients

Potato, peeled	600g
Onion, chopped	90g
Parsley, dried	30g
Pepper	To taste
Mixed herbs	4g

Method

Cook the potatoes for about 10 minutes and allow to cool.
Grate the potato on the rough side of the grater and keep aside.
Heat 2 tablespoons of the oil in a pan over moderate heat and sauté the onion until golden brown.
Add the onion and flavourants to the grated potatoes and mix lightly.
Divide the mixture into 12 equal parts and form into fritters.
Place in the oven at 180ºC for 15 minutes or until brown.
Serve.

Exchanges per Portion

1 Starch High Potassium

Nutritional Analysis

Energy (kJ)	Protein (g)	Fat (g)	CHO (g)	Phosphate (mg)	Potassium (mg)	Sodium (mg)
277	1.4	0.1	13	36	255	4

PUMPKIN FRITTERS

Recipe Yield

Total yield: 600g
100g/portion
6 Portions of 1 large fritter per portion

Ingredients

420g	Pumpkin, cooked and mashed, chilled
1 egg	Egg, large
30g	Flour
8g	Baking powder
125ml	Sunflower oil
4g	Cinnamon
60g	Sugar
140g	Lemon wedges

Method

Mix the pumpkin, flour and baking powder into a soft batter.
Add the egg and beat thoroughly.
Heat the oil in a frying pan.
Drop spoonfuls of the batter into the pan and fry until the fritters are golden brown on both sides.
Remove from the pan and keep hot.
Serve hot with the cinnamon sugar sprinkled over it and the lemon wedges as garnishing.

Exchanges per Portion

1 Vegetable Moderate Potassium
1 Sugar
3 Fat

Nutritional Analysis

Energy (kJ)	Protein (g)	Fat (g)	CHO (g)	Phosphate (mg)	Potassium (mg)	Sodium (mg)
891	1.7	16.4	14.1	140	110	99

Photograph 6.13: Wheat and Mushroom Casserole

Photograph 6.14: Brussels Sprouts with Tomato and Onion Sauce

WHEAT AND MUSHROOM CASSEROLE

Recipe Yield

Total yield: 1456g
182g/portion
8 Portions

Ingredients

60ml	Sunflower oil
150g	Onion, chopped
300g	Mushrooms, fresh, chopped
75g	Green pepper, seeded, chopped
210g	Crushed wheat, uncooked
2g	Mixed herbs
To taste	Pepper
15g	Parsley, chopped

Method

Heat the oil in a pan over moderate heat and sauté the onion, mushrooms and green pepper until the onions become transparent.
Add the wheat, pepper, herbs and enough water and bring to a boil.
Cook until the wheat is fully cooked and all the fluid has been absorbed.
Dish the wheat into a serving dish, sprinkle the chopped parsley over the top and serve.

Exchanges per Portion

1 Starch Low Potassium
1 Vegetable Low Potassium
1 Vegetable High Potassium
2 Fat

Nutritional Analysis

Energy (kJ)	Protein (g)	Fat (g)	CHO (g)	Phosphate (mg)	Potassium (mg)	Sodium (mg)
805	4.3	9.4	16.6	86	280	15

BRUSSELS SPROUTS WITH TOMATO AND ONION SAUCE

Recipe Yield

Total yield: 522g
87g/portion
6 Portions

Ingredients

30ml	Sunflower oil
30g	Onion, chopped
To taste	Garlic cloves
50g	Green pepper, seeded, chopped
300g	Tomatoes, chopped
160g	Brussels sprouts, cooked
5g	Sugar
To taste	Pepper, black, grinded

Method

Heat the oil in a pan over moderate heat and sauté the onion, garlic and green pepper until the onion starts to go transparent.
Add the rest of the ingredients and cook over slow heat for 10 to 15 minutes.
Serve.

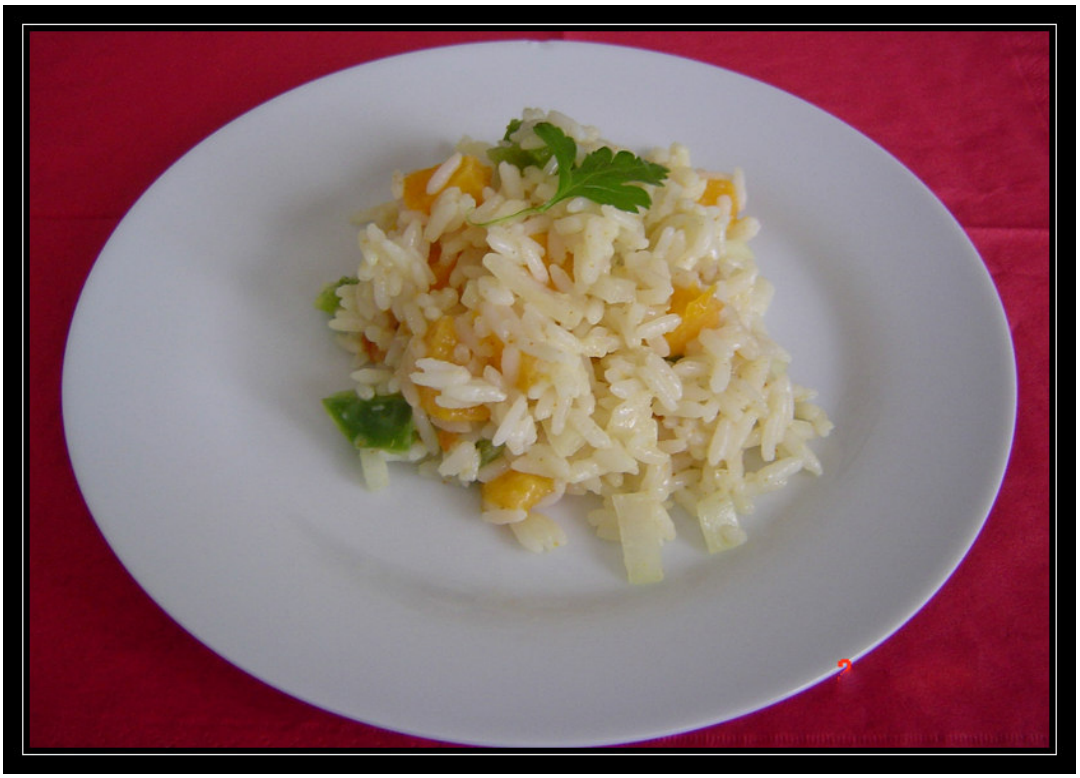
Exchanges per Portion

1 Vegetable Moderate Potassium
1 Fat

Nutritional Analysis

Energy (kJ)	Protein (g)	Fat (g)	CHO (g)	Phosphate (mg)	Potassium (mg)	Sodium (mg)
279	1.2	4.6	3.4	29	186	6

Photograph 6.15: Vegetarian Mushroom Dish



Photograph 6.16: Rice Salad

VEGETARIAN MUSHROOM DISH

Recipe Yield

Total yield: 680g
170g/portion
4 Portions

Ingredients

90g	Onion, chopped
120g	Mushrooms, fresh, chopped
75g	Green pepper, seeded, chopped
3 eggs	Eggs, Large
50g	Margarine
100g	Bread crumbs, brown, fresh
90g	Cheese, finely grated
2g	Mixed herbs
To taste	Pepper

Method

Melt the margarine in a large frying pan and sauté the onion and green pepper over low heat until the onions become transparent but not browned.
Add the mushrooms and sauté for a further 2 minutes.
Remove pan from heat and stir in all the other ingredients *except* the cheese and mixed herbs. Mix well.
Press the mixture firmly into a greased single bread pan and sprinkle the cheese and herbs over the top.
Bake in the oven at 180°C for 45 minutes.
Dish out onto a warm serving plate and serve immediately.

Exchanges per Portion

1 Meat High Phosphate
1 Starch Low Potassium
1 Vegetable Low Potassium
2 Vegetable Moderate Potassium
3 Fat

Nutritional Analysis

Energy (kJ)	Protein (g)	Fat (g)	CHO (g)	Phosphate (mg)	Potassium (mg)	Sodium (mg)
1479	14.4	22.1	22.1	261	280	406

RICE SALAD

Recipe Yield

Total yield: 872g
109g/portion
8 Portions

Ingredients

300g	Rice, cooked
100g	Green pepper, seeded, chopped
120g	Onion, chopped
125g	Peaches, halves, canned, finely chopped
15g	Chutney
20g	Mayonnaise
3g	Curry powder
65ml	Vinegar
10g	Sugar

Method

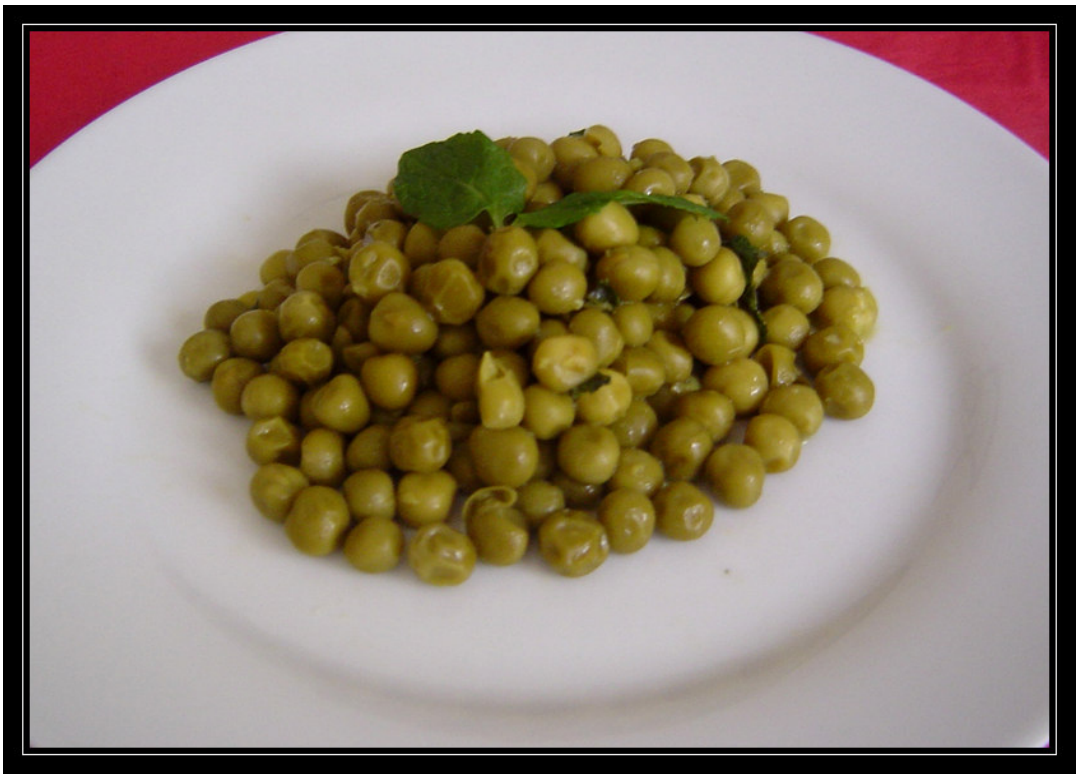
Mix all the ingredients in a large bowl.
Allow to chill in the refrigerator before serving.

Exchanges per Portion

1 Starch Low Potassium

Nutritional Analysis

Energy (kJ)	Protein (g)	Fat (g)	CHO (g)	Phosphate (mg)	Potassium (mg)	Sodium (mg)
439	1.7	1.8	19.2	35	99	45



Photograph 6.17: Peas in Lemon and Mint Sauce

Photograph 6.18: Greenbean, Pea and Mushroom Salad

PEAS IN LEMON AND MINT SAUCE

Recipe Yield

Total yield: 522g
87g/portion
6 Portions

Ingredients

450g	Peas, frozen
60g	Margarine
1g	Lemon zest
15ml	Lemon juice
25g	Mint, fresh, finely chopped

Method

Steam the peas in a bit of water in a large pot for about 5 minutes.
Stir in the other ingredients and transfer into a warm serving dish and serve hot.

Exchanges per Portion

2 Vegetable Low Potassium
1 Fat

Nutritional Analysis

Energy (kJ)	Protein (g)	Fat (g)	CHO (g)	Phosphate (mg)	Potassium (mg)	Sodium (mg)
583	4.1	8.8	6.4	62	201	50

GREENBEAN, PEA AND MUSHROOM SALAD

Recipe Yield

Total yield: 400g
100g/portion
4 Portions

Ingredients

125g	Green beans, thinly sliced
15ml	Sunflower oil
100g	Mushrooms, brown, sliced
50ml	Lemon juice
To taste	Pepper, black, grinded
100g	Peas

Method

Steam the green beans for 4 to 5 minutes until almost soft. Drain and allow to cool.
Heat the oil in a frying pan and sauté the mushrooms for 2 to 3 minutes.
Dish the mushrooms into a salad bowl.
Add the lemon juice, pepper, green beans and peas and mix.
Allow to cool.
Serve.

Exchanges per Portion

2 Vegetable Low Potassium
2 Vegetable Moderate Potassium
1 Fat

Nutritional Analysis

Energy (kJ)	Protein (g)	Fat (g)	CHO (g)	Phosphate (mg)	Potassium (mg)	Sodium (mg)
643	7.8	4.2	12.3	133	437	9

Photograph 6.19: Curried Wheat Salad

Photograph 6.20: Cabbage Pot

CURRIED WHEAT SALAD

Recipe Yield

Total yield: 1404g
117g/portion
12 Portions

Ingredients

600g	Crushed wheat, cooked
125g	Peaches, canned in syrup, chopped
210g	Pineapple, fresh, chopped
50g	Green pepper, seeded, chopped
240g	Tomatoes, chopped
90g	Onion, sliced in rings
15g	Chutney
60g	Mayonnaise
3g	Curry powder
10ml	Lemon juice

Method

This recipe can be prepared the day before serving.
Mix the wheat lightly with the fruits and vegetables.
Add the chutney, curry powder and lemon juice to the mayonnaise and mix well.
Carefully mix it into the wheat mixture so that the peaches and tomatoes don't break.
Allow to chill in the refrigerator and serve.

Exchanges per Portion

1 Starch High Potassium
1 Fruit Low Potassium

Nutritional Analysis

Energy (kJ)	Protein (g)	Fat (g)	CHO (g)	Phosphate (mg)	Potassium (mg)	Sodium (mg)
423	2.1	2.9	13.3	33	143	54

CABBAGE POT

Recipe Yield

Total yield: 1048g
131g/portion
8 Portions

Ingredients

60ml	Sunflower oil
510g	Cabbage, chopped
90g	Onion, chopped
300g	Potato, peeled and sliced
90g	Carrots, sliced
2g	Mixed herbs
To taste	Pepper

Method

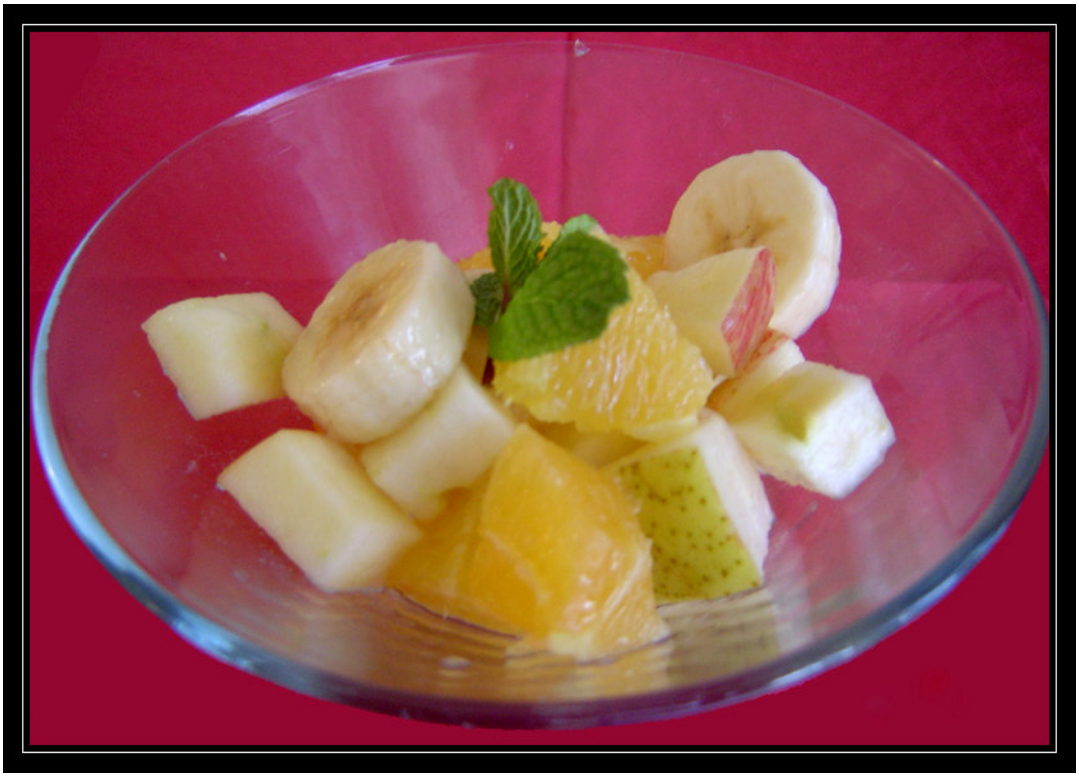
Heat the oil in a pan over moderate heat and sauté the onion until golden brown. Add the vegetables, mixed herbs, pepper and a bit of water and cook until soft.
Dish out into a serving dish and serve.

Exchanges per Portion

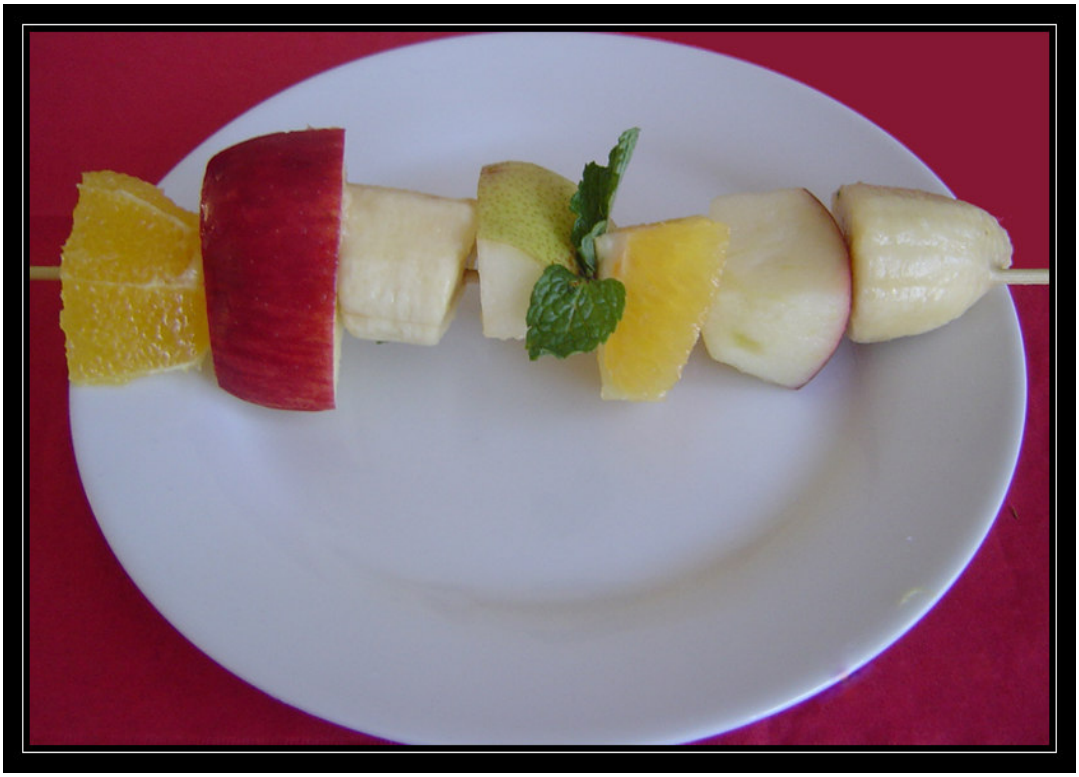
3 Vegetable Low Potassium
2 Fat

Nutritional Analysis

Energy (kJ)	Protein (g)	Fat (g)	CHO (g)	Phosphate (mg)	Potassium (mg)	Sodium (mg)
532	1.8	7.6	10.7	47	304	30



Photograph: 6.21: Fruit Salad



Photograph 6.22: Fruit Kebabs

FRUIT SALAD

Recipe Yield

Total yield: 1500g
150g/portion
10 Portions

Ingredients

300g	Apples, cut into blocks
150g	Bananas, thickly sliced
150g	Pear, peeled and cut into blocks
360g	Oranges, peeled and divided into segments
200g	Pineapple, pieces, canned
Marinade	
125ml	Orange juice
30g	Honey
60ml	Lemon juice

Method

Mix all the ingredients of the marinade and add the fruit.

Exchanges per Portion

1 Fruit Low Potassium
1 Fruit Moderate Potassium

Nutritional Analysis

Energy (kJ)	Protein (g)	Fat (g)	CHO (g)	Phosphate (mg)	Potassium (mg)	Sodium (mg)
429	0.8	0.2	20.8	18	212	3

FRUIT KEBABS

Recipe Yield

Total yield: 1200g
100g/portion
12 Portions

Ingredients

300g	Apples, cut into blocks
150g	Bananas, thickly sliced
150g	Pear, peeled and cut into blocks
360g	Oranges, peeled and divided into segments
250g	Pineapple, pieces, canned
12	Kebab sticks
Marinade	
125ml	Orange juice
125ml	Lemon juice
1g	Mint
30g	Honey

Method

Mix all the ingredients of the marinade and allow the fruit to marinade in it for about an hour. Thread the fruit onto the sticks.

Exchanges per Portion

1 Fruit Low Potassium
1 Fruit Moderate Potassium

Nutritional Analysis

Energy (kJ)	Protein (g)	Fat (g)	CHO (g)	Phosphate (mg)	Potassium (mg)	Sodium (mg)
282	0.6	0.1	13.9	12	144	2

Photograph: 6.23: Baked Apples in Custard Sauce

Photograph 2.24: Fruit Jelly

BAKED APPLES IN CUSTARD SAUCE

Recipe Yield

Total yield: 978g
163g/portion
6 Portions

Ingredients

12.5g	Custard powder
250ml	Water
60g	Sugar
5g	Cloves
5g	Cinnamon stick
500g	Apples
60g	Dates
15g	Raisons
2g	Cinnamon
2g	Ginger
30g	Margarine
50g	Cherries, glazed, chopped

Method

Dissolve the custard powder in 50ml of the water.
Add the remaining water, sugar, cloves and cinnamon stick and place in a pot.
Heat to boiling point while stirring constantly to prevent clots from forming.
Remove the cloves and cinnamon stick.
Peel and seed the apples.
Cut into halves and place in a greased baking dish.
Fill the hollows of the apples with the chopped dates and pour the custard sauce over the top.
Sprinkle the raisons, cinnamon and ginger over the apples and place a dollop of margarine on each of them.
Bake for about an hour at 180℃ until the apples are soft.
Serve hot.

Exchanges per Portion

2 Fruit Low Potassium
1 Sugar
1 Fat

Nutritional Analysis

Energy (kJ)	Protein (g)	Fat (g)	CHO (g)	Phosphate (mg)	Potassium (mg)	Sodium (mg)
681	0.5	4.5	27.3	13	159	27

FRUIT JELLY

Recipe Yield

Total yield: 1800g
100g/portion
18 Portions

Ingredients

1650g	Fruit salad, canned with syrup
25g	Gelatine
45ml	Water, cold
200g	Sugar
375ml	Orange juice, sweetened
50ml	Lemon juice

Method

Remove the syrup from the fruit salad, keep 125ml aside and fill up with water until 375ml.
Heat until boiling point.
Dissolve the gelatin in three tablespoons of cold water and stir into the hot syrup.
Pour the mixture through a fine sift and add the sugar. Stir until the sugar has dissolved.
Add the fruit juices and the fruit salad and mix well.
Pour into a ring shaped dish which has been rinsed with cold water and allow to stand in the refrigerator to set.

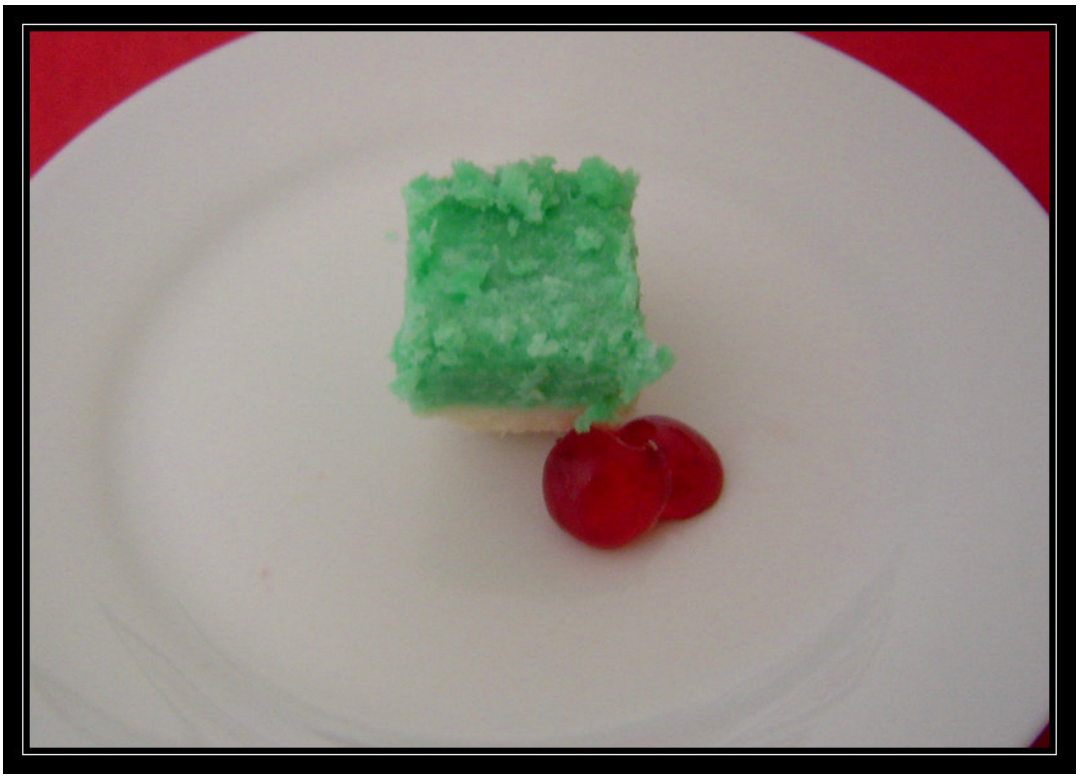
Exchanges per Portion

1 Fruit Low Potassium
1 Sugar

Nutritional Analysis

Energy (kJ)	Protein (g)	Fat (g)	CHO (g)	Phosphate (mg)	Potassium (mg)	Sodium (mg)
447	1.2	0.1	23.8	10	91	8

Photograph 6.25: Date Fingers



Photograph 6.26: Coconut Ice

DATE FINGERS

Recipe Yield

Total yield: 1560g
65g/portion
24 Portions

Ingredients

250g	Margarine
200g	Sugar
500g	Dates, chopped
1 egg	Eggs, beaten
200g	Marie Biscuits
50g	Coconut

Method

Melt the margarine and sugar in a pot over slow heat and stir in the dates.
Add a bit of the date mixture to the beaten egg and mix thoroughly.
Stir the egg mixture into the pot of the date mixture.
Add the biscuits and mix thoroughly.
Pour the mixture into a greased pan and even it out with a knife.
Sprinkle the coconut over and allow to cool.
Cut into strips of about 3 x 6 cm and store in an airtight container.

Exchanges per Portion

1 Starch Low Potassium
1 Fat

Nutritional Analysis

Energy (kJ)	Protein (g)	Fat (g)	CHO (g)	Phosphate (mg)	Potassium (mg)	Sodium (mg)
760	1.3	10.3	20.3	19	103	77

COCONUT ICE

Recipe Yield

Total yield: 1440g
40g/portion
36 Portions

Ingredients

900g	Sugar, white
300ml	Milk
300g	Coconut
2.5ml	Food colouring, pink

Method

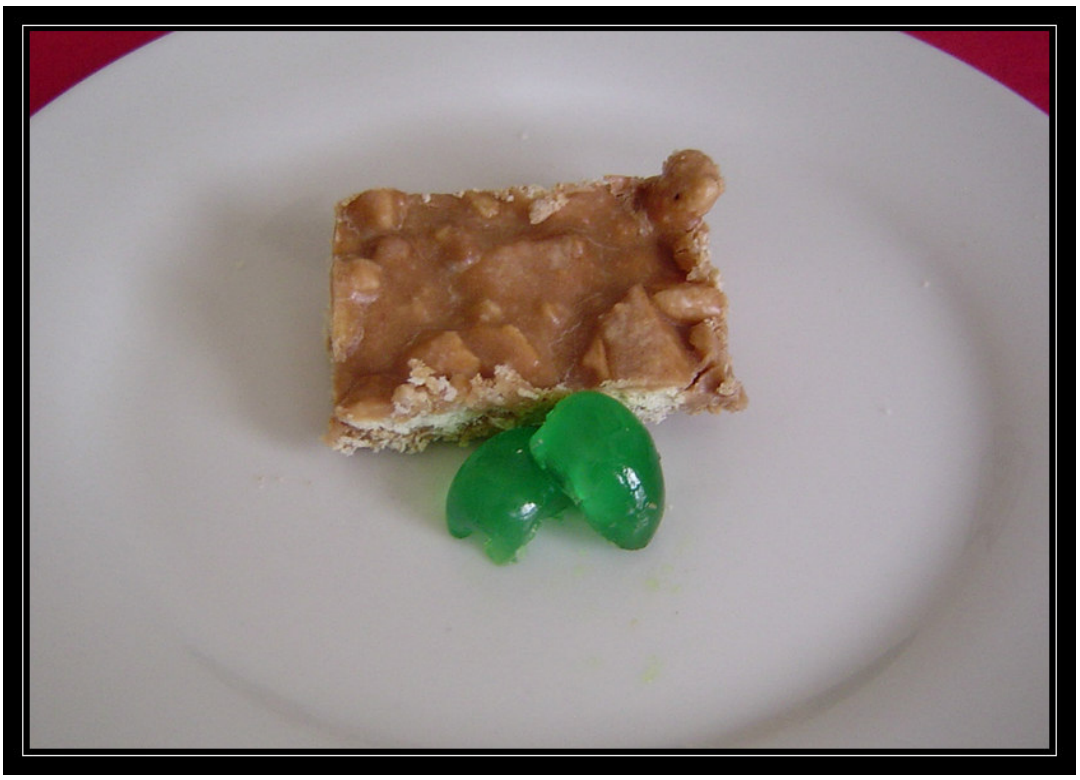
Place the sugar and milk into a heavy-based saucepan. Heat gently, stirring with a wooden spoon until the sugar has dissolved.
Bring to a rapid boil, cover with the lid and boil for 3 minutes.
Uncover and boil for a further 3 - 5 minutes or until the mixture has reached the soft ball stage. (when a little syrup is dropped into iced water it forms a ball which flattens of its own accord when picked up with the fingers. About 25 - 30 minutes)
Remove from the heat and add the coconut. Stir until combined.
Quickly pour half the mixture into a 22cm square greased and lined pan.
Stand the saucepan in a bowl of hot water to prevent setting.
Colour with a few drops of pink food colouring.
Pour the pink mixture over the white mixture working quickly.
Leave till half set.
Cut into squares using an oiled knife.
Leave to set completely.
Store in an airtight container.

Exchanges per Portion

1½ Sugar

Nutritional Analysis

Energy (kJ)	Protein (g)	Fat (g)	CHO (g)	Phosphate (mg)	Potassium (mg)	Sodium (mg)
657	0.8	5.3	24.9	24	56	7



Photograph 6.27: Marie Biscuit Fudge

Photograph 6.28: Cinnamon Sugar Pancakes

MARIE BISCUIT FUDGE

Recipe Yield

Total yield: 1056g
44g/portion
24 Portions

Ingredients

250g	Margarine
500g	Icing sugar
200g	Marie Biscuits
5g	Cocoa powder
5ml	Essence, vanilla
2 eggs	Eggs

Method

Melt margarine and icing sugar and stir in dry ingredients except for the biscuits.
Beat eggs well.
Add the egg and vanilla essence to the mixture.
Break up biscuits and add to mixture and combine well.
Grease and line a loaf tin with greaseproof paper.
Press mixture into tin and allow to set in fridge.
Cut into slices and keep in fridge, separating slices with wax paper.

Exchanges per Portion

1 Starch Low Potassium
½ Sugar
1 Fat

Nutritional Analysis

Energy (kJ)	Protein (g)	Fat (g)	CHO (g)	Phosphate (mg)	Potassium (mg)	Sodium (mg)
856	1.2	10.1	27.1	18	22	127

CINNAMON SUGAR PANCAKES

Recipe Yield

Total yield: 360g
60g/portion
6 Portions

Ingredients

125g	Cake Flour
4g	Baking powder
15g	Sugar
1 egg	Egg, large
250ml	Water
60ml	Oil, sunflower
Topping:	
75g	Sugar
6g	Cinnamon
200g	Lemon, cut into wedges

Method

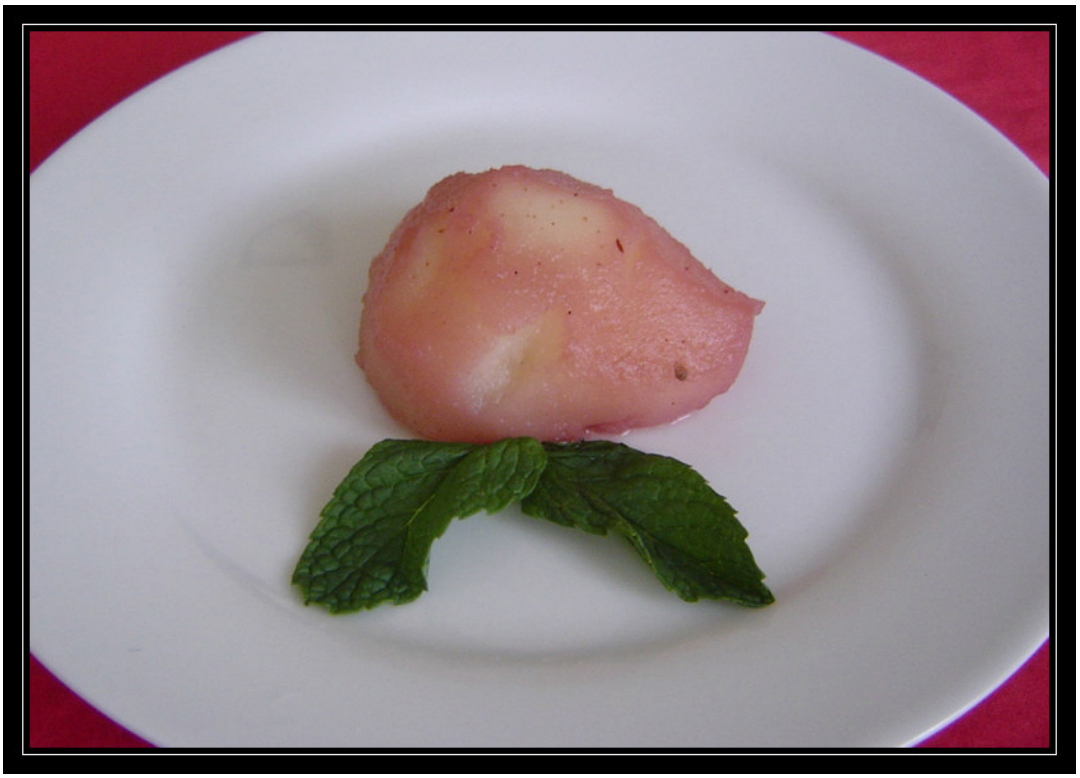
Mix flour, sugar and salt in a bowl. Make a well in the centre and break in the egg.
Gradually stir in half the milk, a little at a time, beating very well.
Add the remaining milk and beat for 5 minutes.
If possible, allow the mixture to stand for an hour or more, as this makes the pancakes lighter. Give it an occasional beating during this time.
Melt 1 tablespoon of margarine in a frying-pan and heat it thoroughly.
Pour off the surplus, leaving just enough to coat the pan.
Pour in a very small amount of the mixture, and tilt the pan to cover it thinly with a layer of batter.
Cook over a medium heat until lightly browned, then loosen with a knife and toss or turn over with a spatula and brown the other side.
Heat the fat in the pan before making each pancake, and keep them warm on a hot dish after cooking.

Exchanges per Portion

1 Starch Low Potassium
1 Fat

Nutritional Analysis

Energy (kJ)	Protein (g)	Fat (g)	CHO (g)	Phosphate (mg)	Potassium (mg)	Sodium (mg)
564	1.6	6.3	17.8	57	24	36



Photograph 6.29: Poached Pears

Photograph 6.30: Baked Apple Pudding

POACHED PEARS

Recipe Yield

Total yield: 494g
62g/portion
8 Portions

Ingredients

400g	Pear, ripe, halved lengthwise, peeled and cored
200ml	Water
50ml	Wine, dry red
1 stick	Cinnamon
1g	Nutmeg, ground
10g	Sugar, white
35g	Lemon, thinly sliced

Method

In a saucepan, combine water, wine, cinnamon, nutmeg, sugar and lemon.
Heat over medium low heat until mixture begins to boil.
Add pears and cook, covered, over low heat for 15 to 30 minutes, or until pears are tender.
Cool and refrigerate for at least 2 hours to chill thoroughly.

Exchanges per Portion

1 Fruit Low Potassium
½ Sugar

Nutritional Analysis

Energy (kJ)	Protein (g)	Fat (g)	CHO (g)	Phosphate (mg)	Potassium (mg)	Sodium (mg)
202	0.2	0.1	8.8	6	55	2

BAKED APPLE PUDDING

Recipe Yield

Total yield: 1320g
110g/portion
12 Portions

Ingredients

410g	Pie apples
30g	Butter
250g	Sugar
2	Eggs, large
150g	Flour, self-rising
62.5ml	Milk, low fat
Sauce	
250g	Sugar
250ml	Cream, fresh
15ml	Essence, caramel

Method

Melt the butter.
Add the sugar to the melted butter and beat mixture well.
Add the eggs one by one and beat well.
Add the flour and milk and beat well.
Dish out into a greased oven dish.
Arrange the pie apple slices on top of the mixture.
Bake at 180℃ for 45 minutes.
Bring the sugar, cream and caramel essence to a simmer in a pot on the stove.
Pour sauce over the baked pie and allow to draw into the pie for 30 minutes.
Serve.

Exchanges per Portion

½ Milk
1 Starch Low Potassium
2 Sugar
1 Fat

Nutritional Analysis

Energy (kJ)	Protein (g)	Fat (g)	CHO (g)	Phosphate (mg)	Potassium (mg)	Sodium (mg)
1264	2.7	9.7	49.7	102	56	196